CHAPTER

1 WORKING WITH XML

LEARNING OBJECTIVES

- To gain understanding of XML
- To understand XML in Excel
- To understand Creating XML Maps from Excel file
- To understand Exporting & Importing XML data
- To understand working with XML tables
- To understand refreshing data from XML

1.1 Introduction

Imagine CFO of a company who regularly looks at financial data. He wants to specify a range of dates and then get aggregate financial data relating to those periods. He wants to see Financial Figures, Revenue streams, Costs summarized by weeks within the specified range. He wants to see the raw data as well as charts showing these trends for the specified date range.

To achieve this some staff, has to sift through lots of data and create separate spreadsheet reports for the different scenarios. The load on IT is huge in the sense that they have to cater to demands of not only CFO but whole lot of diverse departments like Sales, Procurement etc.

A more viable alternative would be where we have an Excel spreadsheet that could adapt itself to deliver the various reports the CFO needs as well as one that other departments could reuse and adjust for their similar needs.

The way out is XML, but let's first understand what XML is.

1.2 Understanding XML

XML is a technology that is designed for managing and sharing structured data in a human-readable text file. XML follows industry-standard guidelines and can be processed by a variety of databases and applications. Using XML, application designers can create their own customized tags, data structures, and schemas. In short, XML greatly eases the definition, transmission, validation, and interpretation of data between databases, applications, and organizations.

XML was designed to transport and store data.

- XML stands for EXtensible Markup Language
- XML is a markup language much like HTML
- XML was designed to carry data, not to display data
- XML tags are not predefined, we must define our own tags
- XML is designed to be self-descriptive
- XML is a W3C Recommendation

The simplest way to explain XML is as a structured way of storing information.

The difference between an XML document and a database (which is also a way of storing structured information) is:

1. A database is a heavy system in that a lot of software goes into creating and maintaining a database; an XML document is based on tags, similar to a HTML document; the difference is that the tags can even be user defined, which means we can store data the way we want, as long as we create the software which can decipher what the data stands for.

2. Even a browser can interpret common XML documents which rely on standard tags.

3. Every database system is proprietary in the sense that even though each can interface with another through defined protocols, the internals are all hidden; an XML document is defined by tags which are within the document, so it is totally open.

XML stands for

- EXtensible

  XML is extensible. It lets us define our own tags, the order in which they occur, and how they should be processed or displayed.

- Markup

  The most recognizable feature of XML is its tags, or elements

- Language

  XML is a language that's very similar to HTML, but much more flexible.

  XML does not DO anything. XML was created to structure, store, and transport information.

The following example is a note to Sachin, from Mahendra, stored as XML:

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<note>
    <to>Sachin</to>
    <from>Mahendra</from>
    <heading>Reminder</heading>
    <body>Meet me at IPL!</body>
</note>
```

The note above is self-descriptive. It has **sender** and **receiver** information, it also has a **heading** and a **message** body.

Honestly, XML document **does not DO anything**. It is just **information** wrapped in **tags**. To send, receive or display it, software would be needed.

XML allows the **author to write their own Tags** and their own data structure.

XML documents form a tree structure that starts at "**the root**" and branches to "**the leaves**".

- The first line is the **XML declaration**. It defines the XML version (1.0) and the encoding used (ISO-8859-1 = Latin-1/West European character set).
- The next line describes the **root** element of the document (like saying: "this document is a note"):

  <note>
- The next 4 lines describe 4 **child elements** of the root (*to, from, heading, and body*):

  ```
  <to>Sachin</to>
  <from>Mahendra</from>
  <heading>Reminder</heading>
  <body>Meet me at IPL!</body>
  ```
- And finally the last line defines the end of the **root** element:

  </note>
- This XML document contains a note to Sachin from Mahendra
- XML Documents Form a **Tree Structure**

  ```
  <root>
    <child>
      <subchild>.....</subchild>
    </child>
  </root>
  ```

The **syntax** rules of XML are very simple and logical

- Every bit of data has to **start and end with an identical tag**: <TagName>Data</TagName>
- Tag names are **case sensitive**. <Body> and </body> are NOT valid tags because the capitalization in the end tag is not the same as the capitalization in the begin tag.
- The XML file must **begin and end with a root tag**. There can only be one root tag in a file. In the example above, the root tag is <Note>.
- We can **have an empty tag** - put the slash at the end of the tag instead of the beginning: <TagName/>
- If we nest tags, we must close the inner tag before closing the outer tag. <Item><a>data</Item> will work, but <Item><a>data</Item>will not.
- XML **Attribute Values must be put within quotes**.

Whether XML File is Valid or not can be checked at http://www.stg.brown.edu/service/xmlvalid/

XML Element

An XML element is everything from (including) the element's start tag to (including) the element's end tag.

An element can contain:

- other elements
- text
- attributes
- or a mix of all of the above...

XML allows us to *separate information from presentation*

An element consists of an opening tag, its attributes, any content, and a closing tag.

A tag – either opening or closing – is used to mark the start or end of an element.

A node is a part of the hierarchical structure that makes up an XML document. "Node" is a generic term that applies to any type of XML document object, including elements, attributes, comments, processing instructions, and plain text.

XML Attributes

Attributes often provide information that is not part of the data

XML Schema

To ensure that everyone plays by the rules, we need a Document Type Definition (DTD), which is called XML Schema, whose purpose is to define the structure of an XML document. It's a lot like a rule book that states which tags are legal, and where.

1.3 XML in Excel

Microsoft Office Excel makes it easy to import Extensible Markup Language (XML) data that is created from other databases and applications, to map XML elements from an XML schema to worksheet cells, and to export revised XML data for interaction with other databases and applications. Think of these XML features as turning Office Excel into an XML data file generator with a familiar user interface.

Excel works primarily with two types of XML files:

- XML data files (.xml), which contain the custom tags and structured data.
- Schema files (.xsd), which contain schema tags that enforce rules, such as data type and validation.

The following are key scenarios that the XML features are designed to address:

- Extend the functionality of existing Excel templates by mapping XML elements onto existing cells. This makes it easier to get XML data into and out of our templates without having to redesign them.
- Use XML data as input to existing calculation models by mapping XML elements onto existing worksheets.
- Import XML data files into a new workbook.

- Import XML data from a Web service into Excel worksheet.
- Export data in mapped cells to XML data files independent from other data in the workbook.

1.4 XML Maps

XML schemas in Excel are called XML maps. XML maps link the cells in a worksheet to the elements (items) in an XML schema. We must build our maps from XML schemas. Because schemas don't contain data, our mapped cells remain blank until we import or otherwise load data into them.

Inferred Schemas

If there is no schema, Excel has a great facility where it infers one from the structure of the tags in an XML data file.

Xml Data File Format vs. XML Spreadsheet Format

The XML Data format allows us to save our data to standard XML data files. The XML Spreadsheet format is proprietary, and requires Excel 2002 or later.

1.5 Create an XML Data File and XML Schema File from Worksheet

Case Study 4.1: We have a salesman wise Invoice List in excel having the headers as which has Sales Id, Salesman, Invoice, Customer and Amount as shown in Fig. 1.5.1. We want to convert it into XML so that the data can be shared by other applications.

	A	B	C	D	E
1	SalesID	Sales Man	Invoice No	Name	Amount
2	101	Desai	11	Amar	6482
3	101	Desai	12	Akbar	2912
4	101	Desai	13	Anthony	4034
5	101	Desai	14	John	8251
6	101	Desai	15	Jani	4160
7	101	Desai	16	Janardan	7966
8	101	Desai	20	Seeta	3376
9	101	Desai	23	Geeta	6625
10	101	Desai	24	Chhote Miyan	8464
11	101	Desai	25	Bade Miyan	3811
12	101	Desai	26	Ram	8558
13	101	Desai	27	Laxman	6347
14	101	Desai	30	Dharam	6300
15	101	Desai	32	Vir	2296

Fig. 1.5.1: Sales list

Strategy:

One simple approach we could think of is to use “Save As” option in Excel and to save the file as XML. Seems like a simple approach, But it doesn’t work, as we try, we get a message that there were no XML mappings found in the workbook. In order to export an Excel worksheet to XML we have to add XML Mappings to the file

- In order to create XML File from worksheet we have to use an add-in *“OfficeExcel2003XMLToolsAddin.*

exe" which is downloadable from Microsoft's site http://www.microsoft.com/en-us/download/details.aspx?id=3108.

- When downloaded.
- Run that exe file which will install at c:\Office Samples\OfficeExcel2003XMLToolsAddin.
- Then to install add-in, we go to File> Option>Add-ins>Excel add-in and browse to locate the file which will be at c:\Office Samples\OfficeExcel2003XMLToolsAddin select the file XmlTools.xla.
- Thereafter, the add-in would be available for installation as shown in Fig. 1.5.2. select XMLTools
- XML Tools would be available in add-Ins Ribbon

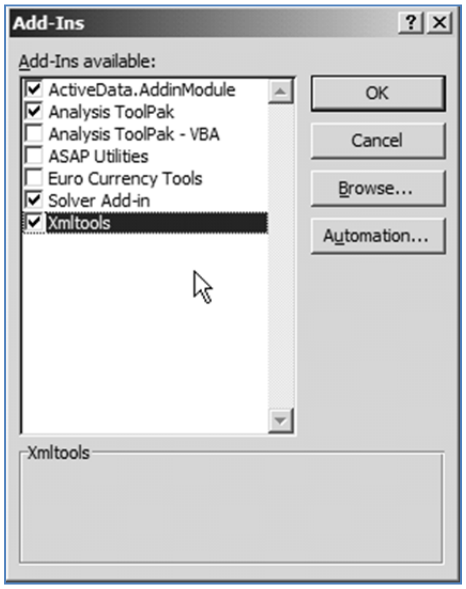


Fig. 1.5.2.: Add-in Dialog Box

- Select the XML tools in the Add-Ins Tab and 'Convert range to an XML list'.

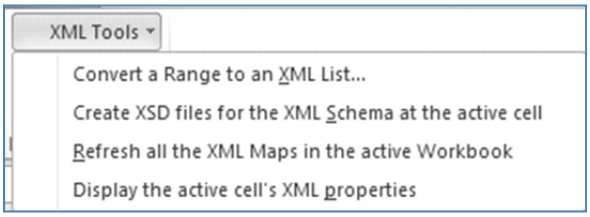


Fig. 1.5.3:XML Tools

- We get a Convert range to an XML List dialog box as shown in Fig. 1.5.4

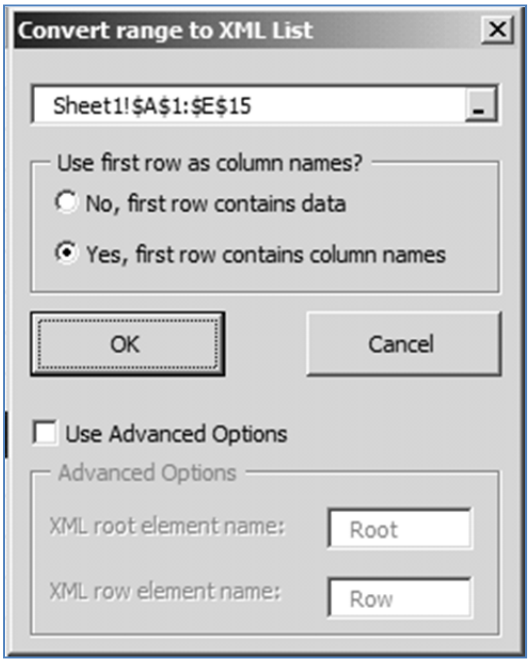


Fig. 1.5.4:Convert Range to XML

- Select range of cells to convert.
- Select first row contains column names.
- Optionally we can choose 'Advanced' to enter our own name for the root of the document and for each row.
- At this stage it asks whether to use existing formatting select that option

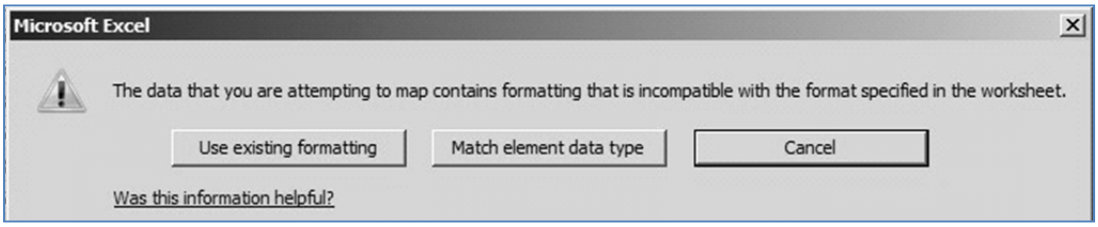


Fig. 1.5.5: Use Existing formatting

- Click ok we see that our range has changed to Table

	A	B	C	D	E
1	SalesI	Sales Man	Invoice N	Name	Amount
2	101	Desai	11	Amar	6482
3	101	Desai	12	Akbar	2912
4	101	Desai	13	Anthony	4034
5	101	Desai	14	John	8251
6	101	Desai	15	Jani	4160
7	101	Desai	16	Janardan	7966
8	101	Desai	20	Seeta	3376
9	101	Desai	23	Geeta	6625
10	101	Desai	24	Chhote Miyan	8464
11	101	Desai	25	Bade Miyan	3811
12	101	Desai	26	Ram	8558
13	101	Desai	27	Laxman	6347
14	101	Desai	30	Dharam	6300
15	101	Desai	32	Vir	2296

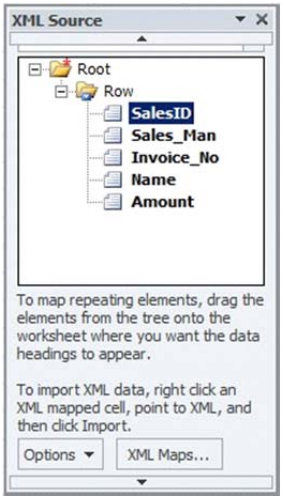


Fig. 1.5.6: XML Source

- At this stage if we go to **Developer>XML> Source** we can see the **XML map** on right side panel.
- We could then go to **Export** in XML Tab and export the file as XML
- Alternatively, we can simply **save the spreadsheet as XML data** with an xml extension.
- Our file is converted to XML as shown in Fig.1.5.7.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
- <Root xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  - <Row>
      <SalesID>101</SalesID>
      <Sales_Man>Desai</Sales_Man>
      <Invoice_No>11</Invoice_No>
      <Name>Amar</Name>
      <Amount>6482</Amount>
    </Row>
  - <Row>
      <SalesID>101</SalesID>
      <Sales_Man>Desai</Sales_Man>
      <Invoice_No>12</Invoice_No>
      <Name>Akbar</Name>
      <Amount>2912</Amount>
    </Row>
  - <Row>
      <SalesID>101</SalesID>
      <Sales_Man>Desai</Sales_Man>
      <Invoice_No>13</Invoice_No>
      <Name>Anthony</Name>
      <Amount>4034</Amount>
    </Row>
```

Fig. 1.5.7: Excel converted to XML

Gist: We have created XML from Sales List in Excel

Commands Learnt: Developer > XML

Food for thought: If, the spreadsheet contains dates or times, we may have problems in conversion, because excel converts it into numbers. Best approach here would be perhaps, reentering the dates as text field.

1.6 Create an XSD Schema File

To create a XSD Schema file,

- Select the XML tools in the Add-Ins Tab.
- Select "Create XSD files for the XML Schema at the active cell"

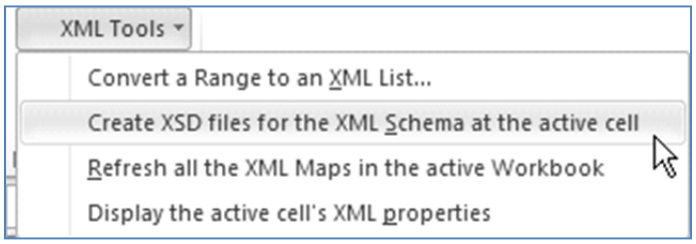


Fig. 1.6.1: Create XSD Files

- An XSD Schema file is created as shown in Fig. 1.6.2.

```
<?xml version='1.0' encoding='UTF-16'?>
<!-- Created from XmlMap.Name: Root_Map -->
<!-- XmlMap.DataBinding.SourceUrl: C:\Users\Administrator\Desktop\Advanced excel\Salesman_Invoice.xml -->
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema">
	<xsd:element nillable="true" name="Root">
		<xsd:complexType>
			<xsd:sequence minOccurs="0">
				<xsd:element minOccurs="0" maxOccurs="unbounded" nillable="true" name="Row" form="unqualified">
					<xsd:complexType>
						<xsd:sequence minOccurs="0">
							<xsd:element minOccurs="0" nillable="true" type="xsd:integer" name="SalesID" form="unqualified"/>
							<xsd:element minOccurs="0" nillable="true" type="xsd:string" name="Sales_Man" form="unqualified"/>
							<xsd:element minOccurs="0" nillable="true" type="xsd:integer" name="Invoice_No" form="unqualified"/>
							<xsd:element minOccurs="0" nillable="true" type="xsd:string" name="Name" form="unqualified"/>
							<xsd:element minOccurs="0" nillable="true" type="xsd:integer" name="Amount" form="unqualified"/>
						</xsd:sequence>
					</xsd:complexType>
				</xsd:element>
			</xsd:sequence>
		</xsd:complexType>
	</xsd:element>
</xsd:schema>
```

Fig. 1.6.2: XSD File

1.7 Delete an XML Map

If we want to delete the XML Map created above we go to XML> Source Pane> XML Maps and a dialog box will appear as shown in Fig. 1.7.1. We have to simply select the map we want to delete and Click "Delete"

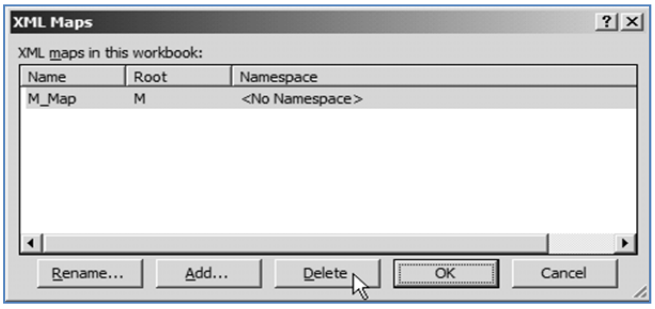


Fig. 1.7.1: Delete XML Map

1.8 Working with XML Tables

By using XML maps, we can easily add, identify, and extract specific pieces of business data from Excel documents. For example, an invoice that contains the name and address of a customer. We can easily import this information from databases and applications, revise it, and export it to the same or other databases and applications.

Excel creates a map for us automatically when we open the XML data file as a Table. Excel uses every element in the schema, and we have no control over the map or the amount of data that Excel loads into the worksheet.

The map becomes part of the workbook, and Excel saves any changes or new data to the workbook in the standard Excel file format (.xlsx). We can only save the workbook as an xlsx file.

We can't export the data from the Table, but we can import new or changed data into the list.

Case Study 4.2: *We have an XML file Salesman Invoice.xml from which we want to create Table.*

Strategy:

- *We open* **Excel** *and on the* **File** *menu, click* **Open.**
- *In the Files of type list, select* **XML files** *(*.xml).*
- *In the Look in list, navigate to the file Salesman Invoice.xml.*
- *Click* **Open.**
- *Open XML dialog box appears.*
- *Select "***As an XML Table***" as shown in Fig, 1.8.1. and click OK.*

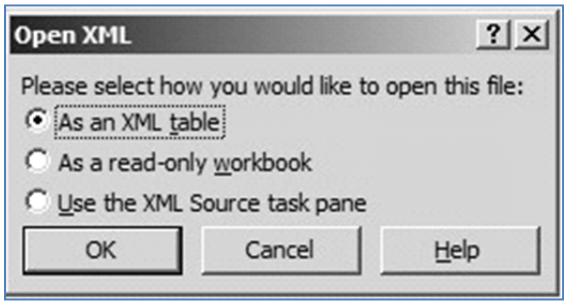


Fig. 1.8.1: Open XML Dialog Box

- *An alert message is seen as shown in Fig click OK.*

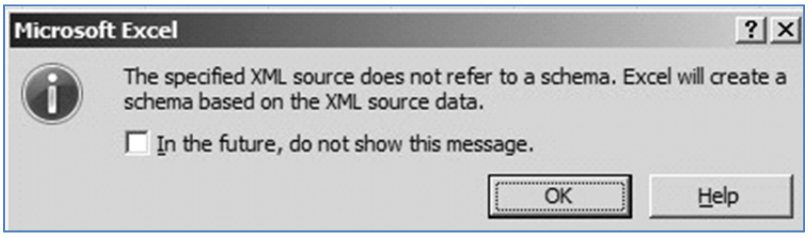


Fig. 1.8.2: Alert Message

- *Excel creates a new, blank workbook and loads the data into an XML list in that workbook.*
- *We can now Click a column header and use the AutoFilter buttons to sort or filter the data.*
- *We can also use the Table Tools tab to turn on the Total row under Table Style options.*
- *We can use the table options with this Table as shown in Fig 1.8.3*

	A	B	C	D	E
1	SalesID	Sales_Man	Invoice_No	Name	Amount
2	101	Desai	11	Amar	6482
3	101	Desai	12	Akbar	2912
4	101	Desai	13	Anthony	4034
5	101	Desai	14	John	8251
6	101	Desai	15	Jani	4160
7	101	Desai	16	Janardan	7966
8	101	Desai	20	Seeta	3376
9	101	Desai	23	Geeta	6625
10	101	Desai	24	Chhote Miyan	8464
11	101	Desai	25	Bade Miyan	3811
12	101	Desai	26	Ram	8558
13	101	Desai	27	Laxman	6347
14	101	Desai	30	Dharam	6300
15	101	Desai	32	Vir	2296

Fig. 1.8.3: Excel sheet created from XML

Gist: We have created Excel Sales Table from XML File

Commands Learnt: XML to Table

1.9 Creating a Map

XML Maps are created from XML Schema. If there is no schema Excel infers one from the structure of the data in the XML file. Schemas don't contain data; the mapped worksheet cells remain empty until data is put into them.

Case Study 4.3: We have an XML file Salesman Invoice.xml from which we want to create Map.

Strategy:

- Open a new Workbook
- On the Developer Tab go to XML, and then click Source.

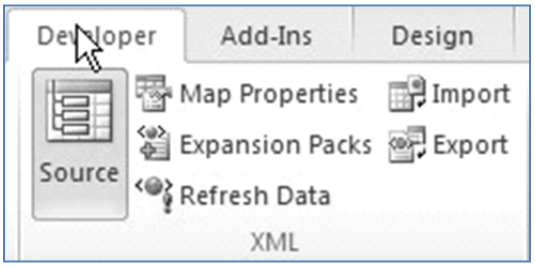


Fig. 1.9.1: XML Source in Developer

- At the bottom of the XML Source task dialog box, click XML maps.

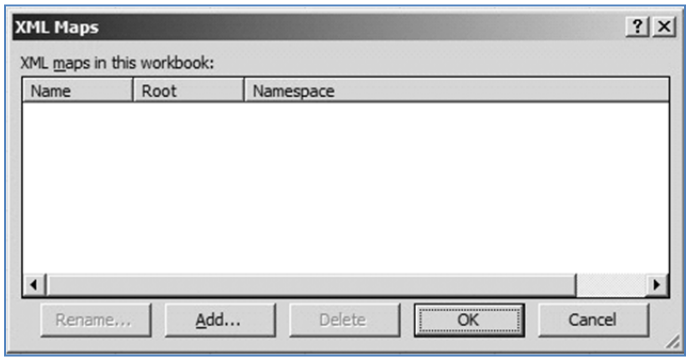


Fig. 1.9.2.: XML Maps Dialog Box

- In the XML maps dialog box, click Add. Find the Salesman Invoice.xml file
- Click Open.
- We get an alert that Excel will create a schema, click OK.
- Excel infers a schema for the XML data file, and the XML Source task pane displays that schema for us to use in creating XML map.

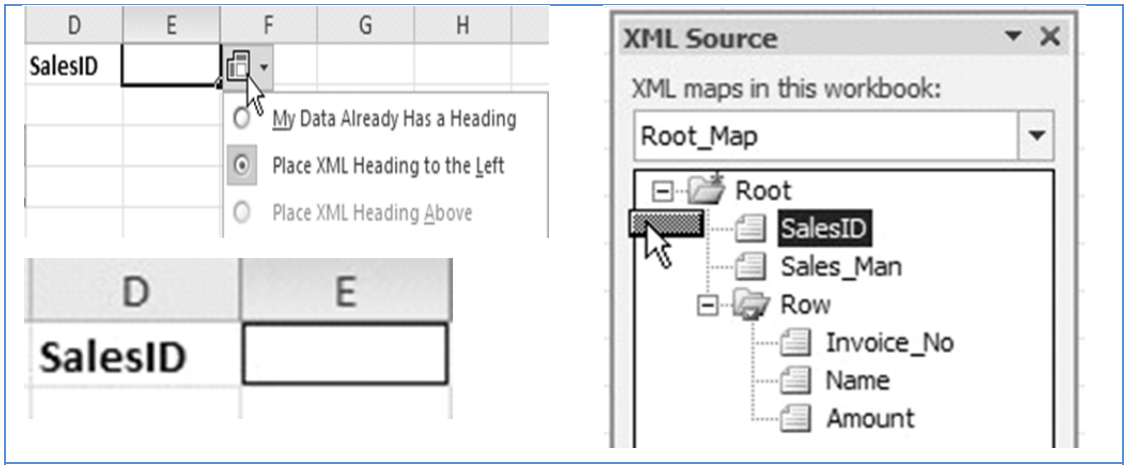


Fig. 1.9.3: Mapping Items

- On the worksheet we start by mapping items that occur only once in the data file. Under Sales ID we drag Sales ID from the task pane to cell E1. Excel surrounds the mapped cell with a Black border, and it displays the Header Options smart tag. Select “Place XML Heading to the left”
- When we click another cell, the border becomes thinner and turns blue as shown in Fig. 1.9.3
- Now drag Sales_man to cell B1.
- We need to also map the data that will occur several times in the worksheet. Drag Row from the XML Source task pane to cell A3. Excel fills cells A3 through C3 with the schema elements located beneath Row. Excel also formats those elements as an XML Table, and an AutoFilter button appears in each cell in row 3 as shown in Fig. 1.9.4.

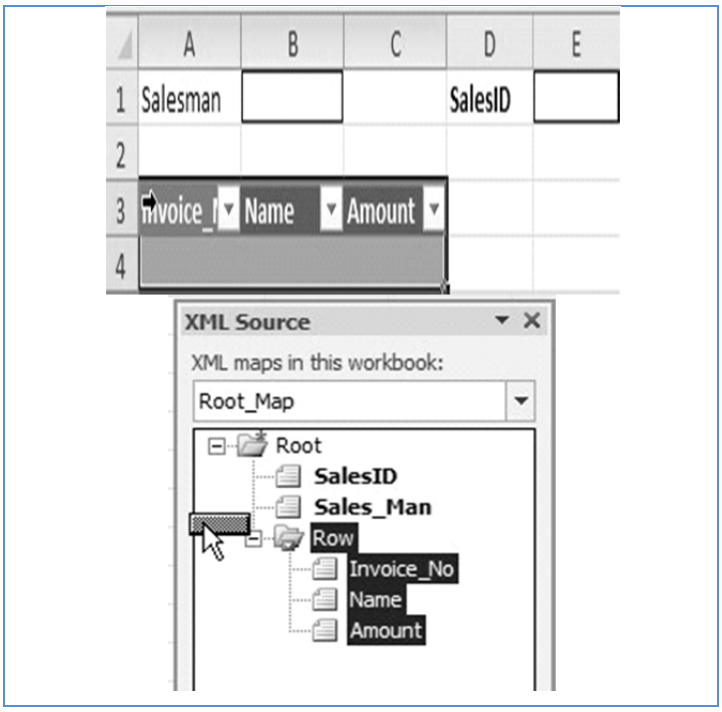


Fig. 1.9.4: Mapping with XML

- Save the workbook.

Gist: We have learnt to create XML Map and create an Excel which can be populated.

Commands Learnt: Developer > XML Source

1.10 Rename an XML Map

If we ever want to rename an XML Map

- Go to XML Source pane Click on XML Maps.
- In XML Maps dialog box

- Right Click on the Map which we want to rename and click rename as shown in Fig. 1.10.1

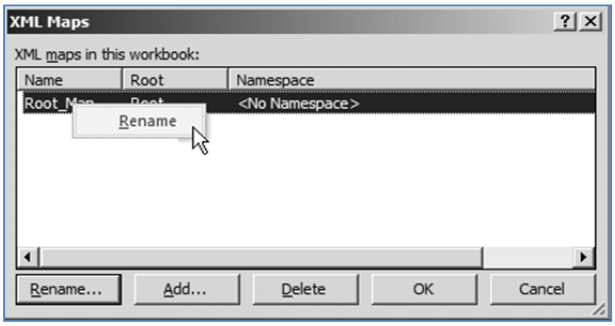


Fig. 1.10.1: Renaming XML Maps

1.11 Import Data into MAP

Case Study 4.4: *We want to populate this worksheet from the contents of file Salesman Invoice.xml.*

Strategy:

We now have a map, and want to import data from the contents of the XML file.

- Select any mapped cell in the worksheet.
- On the Developer Tab go to XML, and then click Import

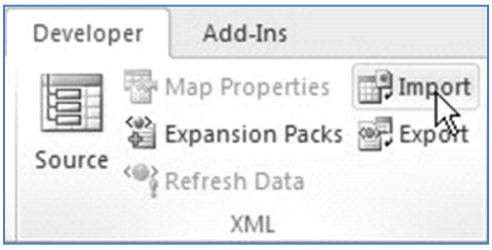


Fig. 1.11.1: Import XML

- Import XML dialog box appears.
- Browse to the Salesman Invoice.xml file, select it, and then click Import.
- Excel loads the XML data into the mapped cells as shown in Fig. 1.11.2.

	A	B	C	D	E
1	Salesman	Desai		SalesID	101
2					
3	Invoice_No	Name	Amount		
4	11	Amar	6482		
5	12	Akbar	2912		
6	13	Anthony	4034		
7	14	John	8251		

Fig. 1.11.2.: Data imported into Mapped Cells

- Save the workbook. Excel saves the data with the worksheet.

- Go to **Developer> XML> Map Properties**.

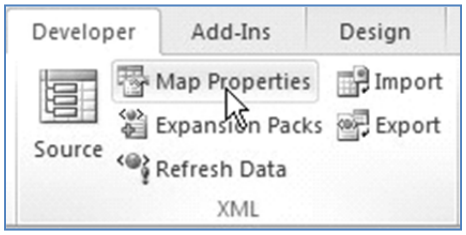


Fig. 1.11.3: Map Properties in XML

- Select Append new data to existing XML Table as shown in Fig. 1.11.4.

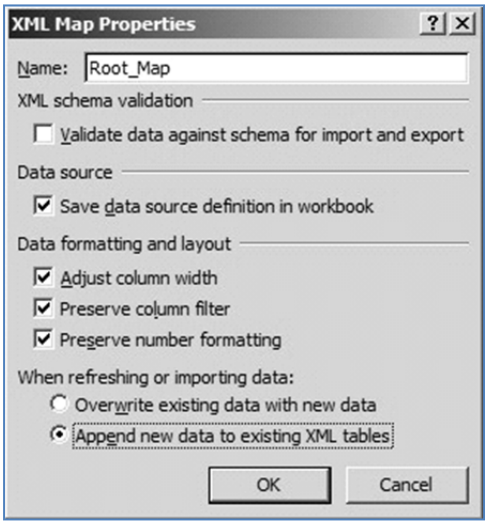


Fig. 1.11.4: XML Map Properties Dialog Box

- Now Excel Table is append able i.e. we can manually add entries.

Gist: We have imported data into Excel from XML

Commands Learnt: Developer > XML Map properties

1.12 Format the Data and Layout of an XML Table

- Select a cell in the XML table.
- Go to **Developer > XML > Map Properties**.
- In the XML Map Properties dialog box, We have various options for formatting the data

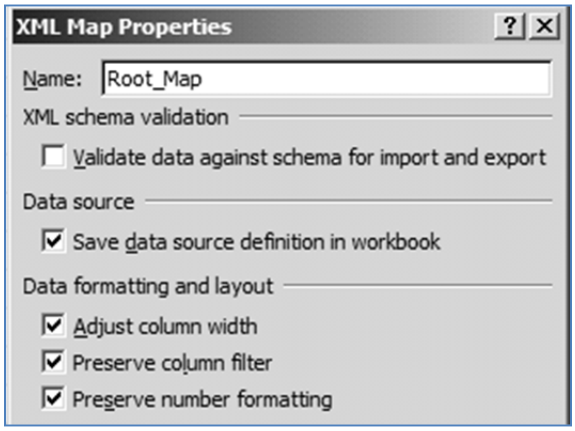


Fig. 1.12.1: Options in XML Map Properties

- Adjust column width

  To automatically adjust column widths for best fit when XML data is refreshed, select this option. This is the default option.

- Preserve column filter

  To preserve sort order and applied filters when XML data is refreshed, select this option. This is the default option.

- Preserve number formatting

  To preserve number formatting when XML data is refreshed, select this option. This is the default option.

1.13 Add-In SG Data

- In the last row press Tab key.
- A new row appears at the bottom of the Table.
- In the last row we Add next Invoice details in A8 to C8 as shown in Fig. 1.13.1.

	A	B	C	D	E
1	Salesman	Desai		SalesID	101
2					
3	Invoice_No	Name	Amount		
4	11	Amar	6482		
5	12	Akbar	2912		
6	13	Anthony	4034		
7	14	John	8251		
8	15	Jan	6625		

Fig. 1.13.1: Add-In SG Data

- Save the workbook.

1.14 Export Mapped Data

After making the changes we can also export the Data. In the export process only the data in the mapped cells of the worksheet are exported.

- Select any mapped cell in the practice worksheet.
- Go to Developer>XML>Export.

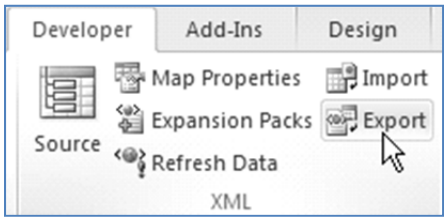


Fig. 1.14.1: Export data

- Export XML dialog box appears.
- Give the path, enter a name for the exported file, and then click Export.
- An XML File is created as shown below and the data we appended manually is appended in XML also as shown in Fig. 1.14.2.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
- <Root xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <SalesID>101</SalesID>
    <Sales_Man>Desai</Sales_Man>
  - <Row>
      <Invoice_No>11</Invoice_No>
      <Name>Amar</Name>
      <Amount>6482</Amount>
    </Row>
  - <Row>
      <Invoice_No>12</Invoice_No>
      <Name>Akbar</Name>
      <Amount>2912</Amount>
    </Row>
  - <Row>
      <Invoice_No>13</Invoice_No>
      <Name>Anthony</Name>
      <Amount>4034</Amount>
    </Row>
  - <Row>
      <Invoice_No>14</Invoice_No>
      <Name>John</Name>
      <Amount>8251</Amount>
    </Row>
  - <Row>
      <Invoice_No>15</Invoice_No>
      <Name>Jan</Name>
      <Amount>6625</Amount>
    </Row>
  </Root>
```

Fig. 1.14.2.: XML File created after addition of data

- The data file is generic XML, so other people or programs can reuse this data.

1.15 Moving Mapped Cells

To move mapped cells, we cut and paste just the way we do when moving any other data. Rules to follow when moving mapped cells

- To move an XML table e.g Invoices and keep it as a Table, **entire set of cells has to be moved together.**
- If we **move individual cells** or columns from the list, **moved cells will not function as Tables**
- Maps apply to one worksheet only.
- If mapped cells are copied to another worksheet or workbook, **recreate the map.**
- Excel does not export the data that has been moved out of mapped cells.
- The **export process works on mapped cells only**.
- In the Salesman Invoice workbook, select the Table that contains the Invoice: cells A3 through C8.
- Press CTRL+C to copy the cells.
- Select cell A10, press CTRL+V to paste the cells into the new location, and then press ESC.
- The destination cells are in Table form.
- Select and copy cells B3 through C8, the Customer and Amount columns.
- Select cell A10, and then paste the copied data.
- When we paste the data, Excel doesn't format it as a Table

10	Nam	Amount
11	Amar	6482
12	Akbar	2912
13	Anthony	4034
14	John	8251
15	Jan	6625

Fig. 1.15.1: Table formatting removed

1.16 Remove Mapped Cells from a Worksheet

Remove mapping leave data

- Go to **Developer>XML>Source**.
- In the XML Source task pane, right-click the element that we want to remove and click Remove element as shown in Fig. 1.16.1.

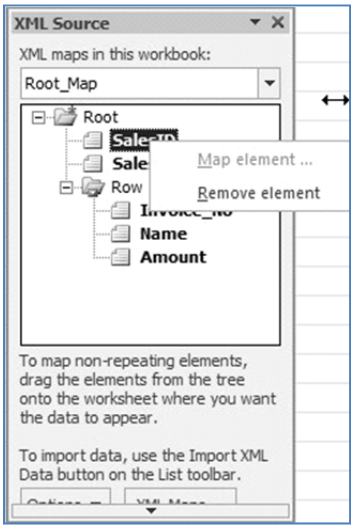


Fig. 1.16.1: Remove Element

All the mapped schema elements appear in heavy dark letters. We can one by one remove element in all mapped cells. Alternatively we can remove element in parent element.

1.17 XML Map Security-Remove Data Source Information

An XML map and its data source information are saved with the Excel workbook, not a specific worksheet. This map Information can be seen by someone with a little bit of VBA knowledge.

If we want to keep using the map information but remove the potentially sensitive data source information, we can delete the data source definition of the XML schema from the workbook, but still export the XML data,

- Go to Developer> XML> Map properties and clearing the Save data source definition in workbook check box as shown in Fig. 1.17.1

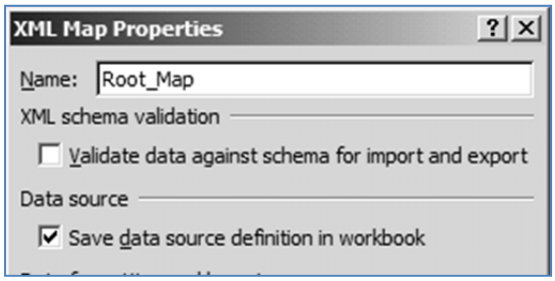


Fig. 1.17.1: Clear save data source

1.18 Refresh Data in an Imported File

- On the worksheet, click a mapped cell to select the XML map that we want to refresh.
- On the Developer tab, in the XML group, click **Refresh Data**.

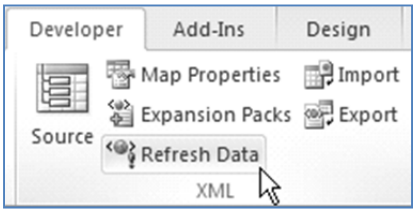


Fig. 1.18.1: Refresh data

- If we want to **refresh data automatically** every time a workbook is opened.
- Go To **Data Tab >Connections**, click the arrow next to Refresh, and then click Connection Properties as shown in Fig. 1.18.2.

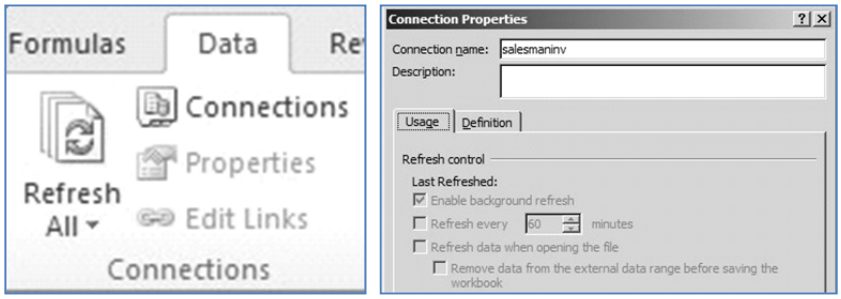


Fig. 1.18.2: Automatically refresh data

- Under **Usage > Refresh control** set the preferences like "Refresh data when opening the file".

1.19 Validate Data against Schema for Import and Export

If we want to ensure that the XML data that we are importing or exporting conforms to the XML schema. Excel provides us with a facility to validate data against the XML map when Importing/Exporting data.

- *Go to Developer> XML> Map properties and click the **Validate Data Against Schema For Import And Export** check box as shown in Fig. 1.19.1*

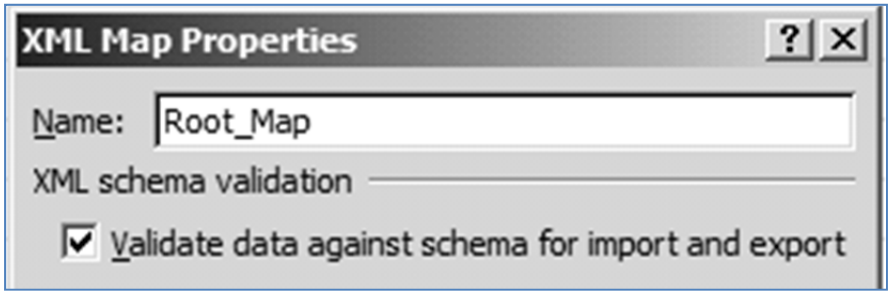


Fig. 1.19.1: Validating Data against schema

1.20 Summary

XML is a great way of Exchanging information between Computer applications

Excel is a great tool which allows us to import from or export to XML.

In this chapter, we learned how to install XML Tool add-Ins from Microsoft, we learned basics of XML, converting XML to Excel and vice versa, creating an XML data File & Schema file. Create, rename, remove XML Map are important when we want to Add Data from XML and export it to XML.

We have also learnt to refresh data from XML manually, or automatically

References

[1] Matthew MacDonald, 'Excel 2010, THE MISSING MANUAL, O'Reilly Media, Inc, 2010

[2] http://office.microsoft.com

[3] http://www.sitepoint.com/really-good-introduction-xml/

CHAPTER

2 ADVANCES IN MACROS

LEARNING OBJECTIVES

- To gain understanding of Macros
- To understand Recording of Macros
- To understand Assigning a button to Macros
- To understand Absolute & Relative references in Macros

2.1 Introduction

We all want shortcuts and to avoid the chore of doing monotonous work like data entry or some formatting which we want done every time. Excel offers us excellent options to automate in the form of Macros which are basically small programs which automatically perform repetitious steps.

2.2 What is a Macro

Programming of Macros is done in programming Language VBA (Visual Basic for Applications) but we can use Macros even if we do not know VBA since Excel gives us a wonderful tool in the form of Macro Recorder. A macro records our mouse clicks and keystrokes while we work and play them back later

Macros can be written in two ways

- Writing a Macro using VBA Code
- Recording a macro using Excel Macro recorder

2.3 Recording a Macro

If we have to store Macros it is not possible in *.xlsx* files. Fortunately excel has a file extension *.xlsm* which are macro enabled workbooks. Excel gives macro-enabled workbooks a different icon, with a superimposed exclamation mark.  This icon enables us to recognize a macro-enabled workbook.

Some tips to record a macro

- Excel records every keystroke & every command we run, so something we don't want should not be done while recording Macro.
- We don't need to work fast, *i.e.*, Macro just records our actions, so if we are just browsing, that is not recorded it is only specific actions which get recorded.
- Try to be generic, since we'd want that macro to run in various situations & scenarios.

2.3.1 Enabling Macro Security

- On the Developer tab, click Macro Security in the Code group.
- The Security dialog appears.
- In the Security dialog, change the Macro Settings to Disable All Macros with Notification.
- With this setting, Excel alerts us whenever we open a workbook that has macros attached.
- When we open a document and get the warning that the document has macros attached, if this is a document that we wrote and we expect macros to be there, click Enable Content to enable the macros

2.3.2 Where Macros Are Stored

Macros can be stored in either of two locations, as follows:

- The workbook we are using, or
- Our Personal Macro Workbook (which by default is hidden from view)

If our macro applies to all workbooks, then store it in the Personal Macro Workbook so it will always be available in all of our Excel workbooks; otherwise we store it in our current workbook

Case Study 2.1: CA P C Gupta gives us a boring routine in Excel, he says when analyzing Debtors List in excel sheet wherever we find an aberration which needs to be investigated further, we are to highlight the cell. To highlight, Font in bold, the cell fill color has to be changed to pink, font color to blue and insert border for the cell. It is really a chore to do it every time. We want to automate this routine and assign a shortcut key for it.

	A	B
1	**Name**	**Amount**
2	ABC Ltd	8,11,89,144
3	XYZ LLP	2,40,17,917
4	ABC &Sons	2,11,69,325
5	UVW LLP	5,74,31,089
6	GHJ Associates	1,66,96,547
7	SDF P. Ltd.	3,44,46,923
8	TYU Inc	4,78,98,097
9	IOP & sons	2,43,92,473
10	RET & Co.	27,45,265
11	FGH Ltd.	3,36,31,684
12	NMB P. Ltd.	41,83,796
13	UTE LLP	4,56,78,932

Fig. 2.3.1: Debtors Data

Strategy:

We can automate this boring task using Macros in Excel

We can record a Macro in 3 different ways

- In Excel 2010 Macros are in Developer Tab, which is not there by default.
- To activate it we have to go to File> Options as shown in Fig. 2.3.2

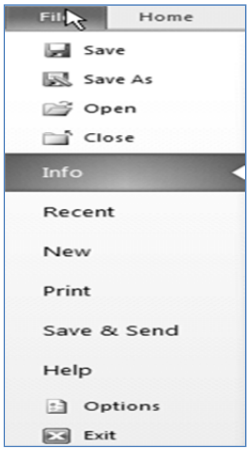


Fig 2.3.2: Options in File Tab

- Under Options > Customize the Ribbon > On the right of the window, a large box lists all the tabs that are currently shown in the ribbon. Near the bottom, we see an unchecked item named Developer as shown in Fig. 2.3.3. To show the Developer tab, check this box, and then click OK.

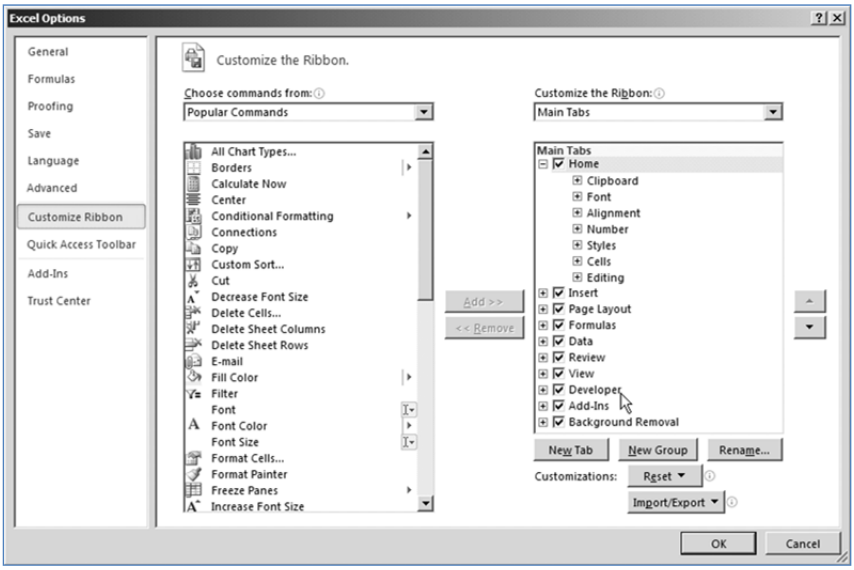


Fig 2.3.3: Customize ribbon in options

- Macros are under **Developer** tab as shown in Fig. 2.3.4

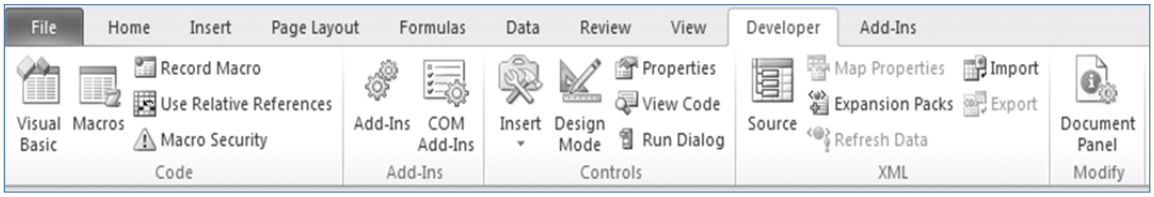


Fig. 2.3.4: Macros in Developer tab

- Recording a Macros is also available in **View> Macros** as shown in Fig. 2.3.5

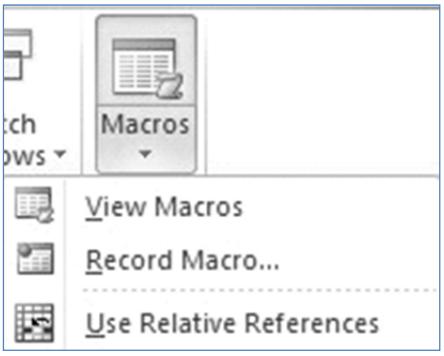


Fig. 2.3.5: Macros under view

- There is **one more option** to record macro in **status bar** as shown in Fig. 2.3.6

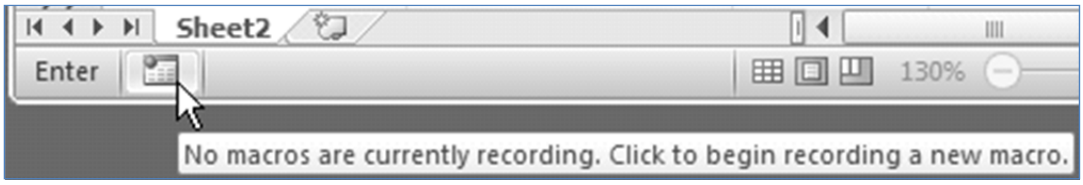


Fig. 2.3.6: Record a macro in status Bar

- Using any of the above methods we start recoding a Macro, a **macro dialog box** appears as shown in Fig. 2.3.7

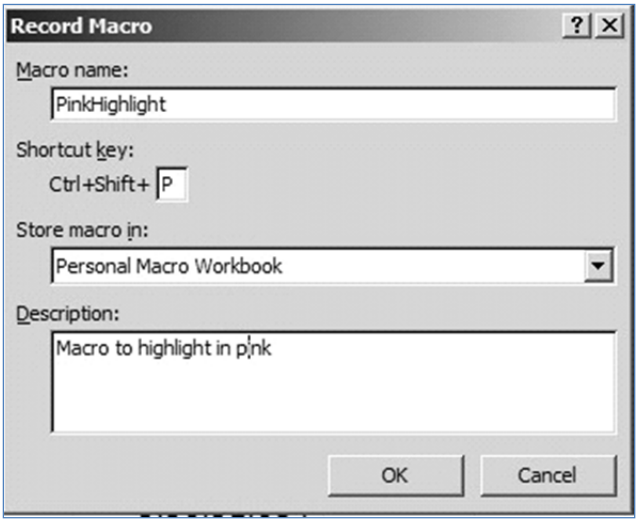


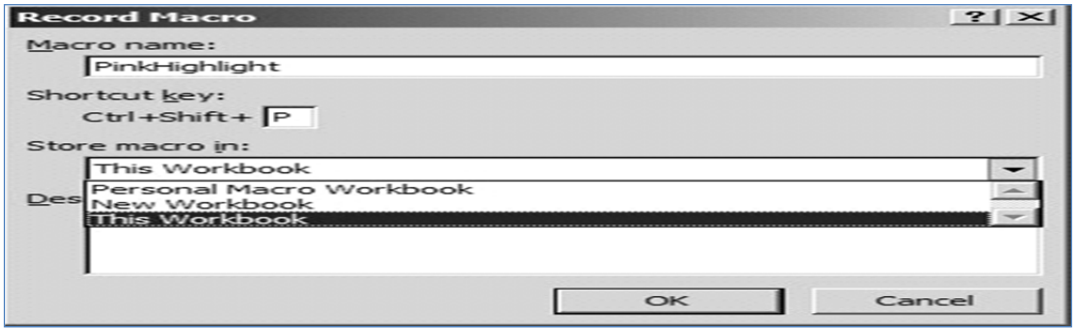
Fig. 2.3.7: Record a macro in status Bar

- We give macro a name let's say *"PinkHighlight"* , we can also attach a shortcut key to it, since most of Ctrl + short cut keys are already reserved it is better to go for Ctrl+Shift+. In this case we select "Ctrl+Shift+P" just a mnemonic since we want to go for pink highlight. Further Macro can be stored in:
- This Workbook.

  If we choose this option, Excel stores our macro in the current workbook. Remember, we need to save this workbook as a macro-enabled .xlsm file or a binary *.xlsb* file, or we'll lose our macros.
- New Workbook.

  If we choose this option, Excel automatically creates a new workbook (which it opens in a separate window) and stores our macro there.
- Personal Macro Workbook.

  If we choose this option, Excel stores our macro in a special hidden workbook named Personal.xlsb. The Personal.xlsb workbook opens automatically whenever we start Excel (although it remains hidden), so macros in this workbook are always available no matter what workbook we're using.



- We store the macro in personal workbook since we want it to be available for all workbooks.

- We also give the macro a description **"Macro to highlight in pink"**.
- As we begin recording we see that record macro button has changed to "**stop recording**" in both header & status bar as shown in Fig. 2.3.8

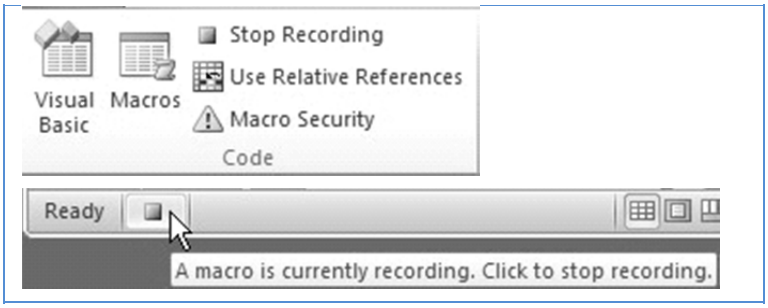


Fig. 2.3.8: Stop recording in developer tab & status Bar

- Now we **perform the recording** of action
  - we select B10 which we need to highlight in pink and
  - go through the desired steps on Home Tab first we make the font **Bold**,
  - next we change the font colour to Blue,
  - Change the fill to Pink &
  - Insert a border for the cell.
- We now **click** the **stop recording** Button
- Our macro is now ready, to execute **on any cell press Ctrl+Shift+P** and we find that the cell gets the desired formatting

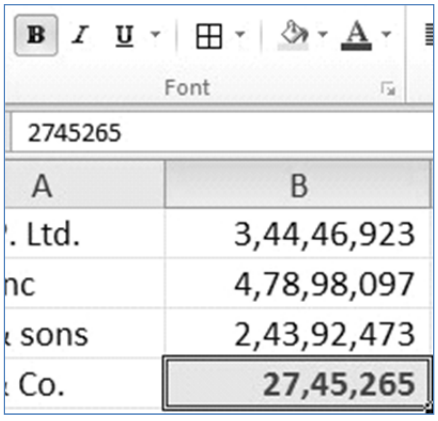


Fig. 2.3.9: Macro is executed on pressing Ctrl+Shift+P

Gist: We have recorded a macro to give the desired pink highlighting to a cell to Excel both in static format as well as dynamic format

Commands Learnt: Record a Macro

2.4 Assigning a Button to Macro

We have seen that Macros make our repetitive job a lot easier to perform but it would be extremely useful if we can run macro with a simple click on button, rather than running it manually. By creating macro-buttons we will be able to associate macros with buttons, and show them on the worksheet for performing different tasks we have recorded with macro. Excel enables us to create custom buttons to link macros with them, the following case study will elaborate how to create macros and associate buttons with them.

Case Study 2.2: In case study 6.1 we wish to assign a button in Quick Access Toolbar & also make a button on the worksheet for one touch macro execution.

Strategy:

We can assign Buttons for macros in many ways we will discuss two of them.

Button on Quick Access Toolbar (QAT)

- **Right click** on Quick Access Toolbar (QAT) and select the option "**Customize Quick Access Toolbar**" as shown in Fig. 2.4.1

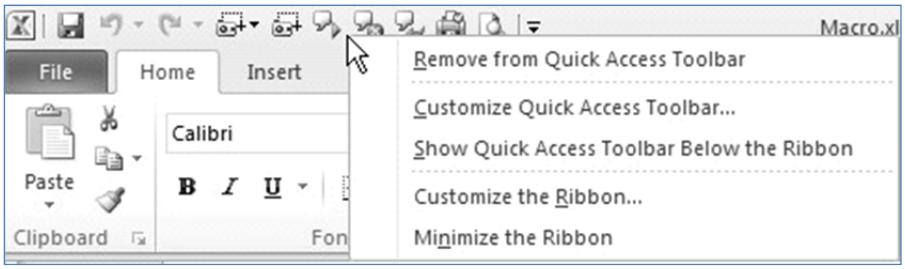


Fig. 2.4.1: Customize Quick Access Toolbar

- Select the "**Macros**" under "**Choose commands from**"

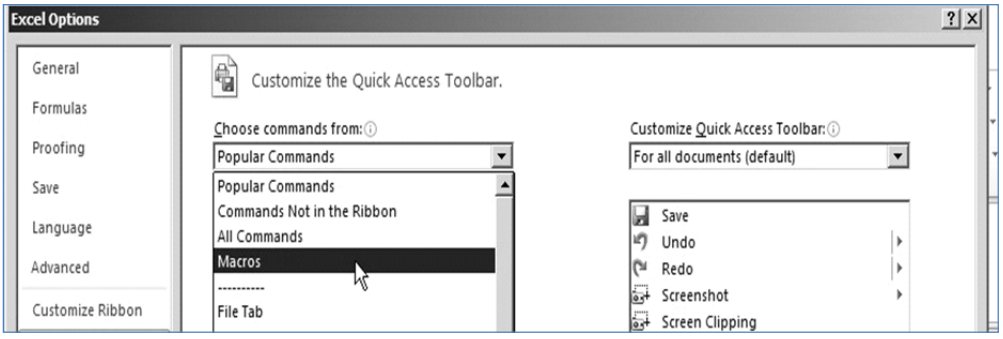


Fig. 2.4.2: Select macros

- Under **Macros** select the Macro we wish to add to QAT in this case "*PERSONAL.XLSB!PinkHighlight*" >*add* as shown in Fig. 2.4.3

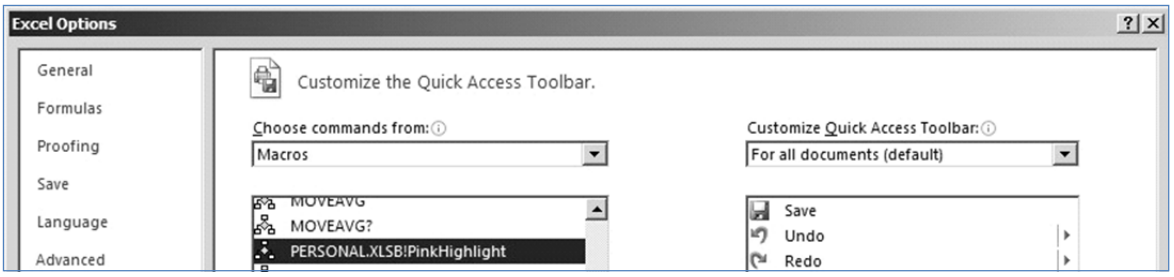


Fig. 2.4.3: Select PERSONAL.XLSB!PinkHighlight

- Select *PERSONAL.XLSB!PinkHighlight* in the right pane & click **Modify** we see lot of symbols which we can assign any pink symbol to make it easy for us to recall and also change the display name to Pink Highlight and **click OK** as shown in Fig. 2.4.4

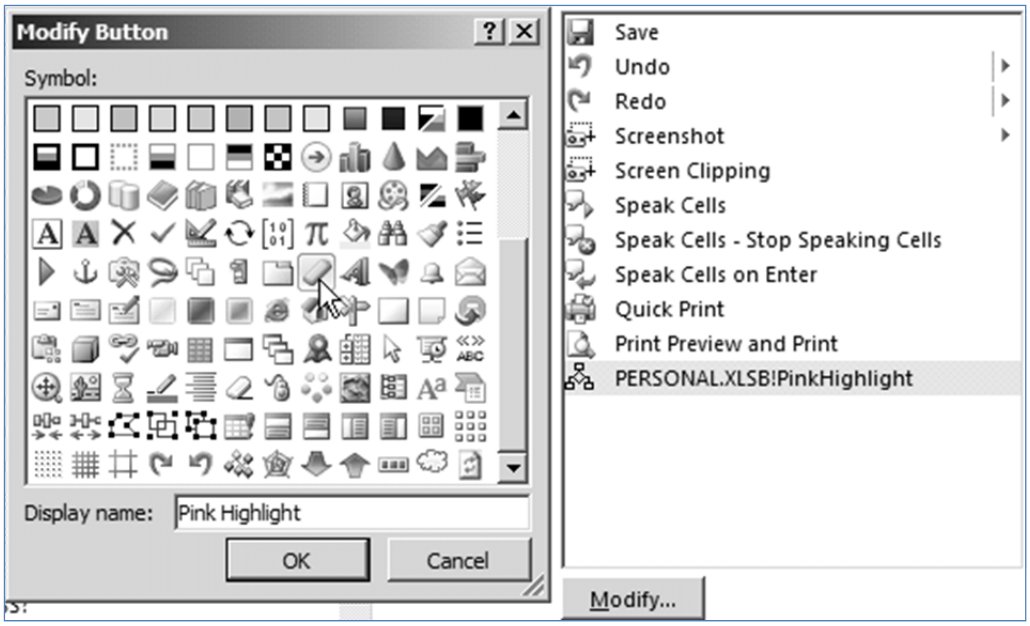


Fig. 2.4.4: Modify Button

- We see that a **new Button for pink highlighting is added** to our toolbar.

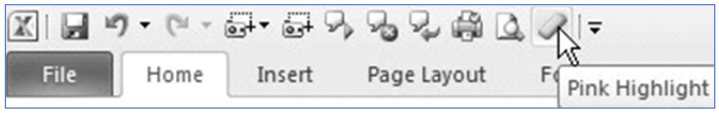


Fig. 2.4.5: Pink highlights Button on QAT

- By clicking this button in QAT we can run this macro.
- Another button we can have on the sheet itself.
- We go to **Insert>Shapes>** select a shape, let's say "5-Pointed Star"

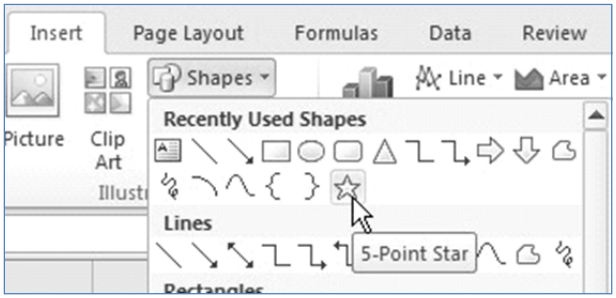


Fig. 2.4.6: Select Shapes from Insert

- Next we go to **shape fill & select a color**, we select pink since we want to use it for pink highlighting.

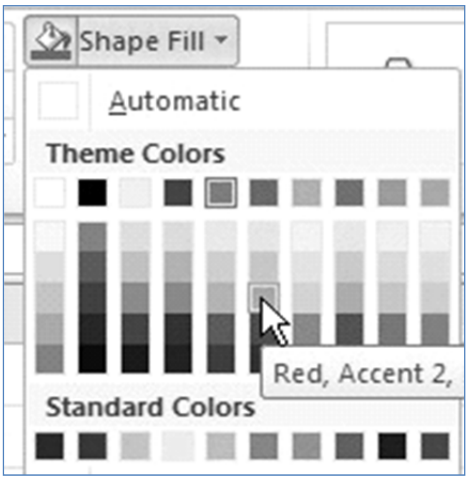


Fig. 2.4.7: Pink highlight Button on QAT

- We also go to txt box & give the star a caption "**Pink**"
- We then **right click** on the star & select "**Assign Macro**"

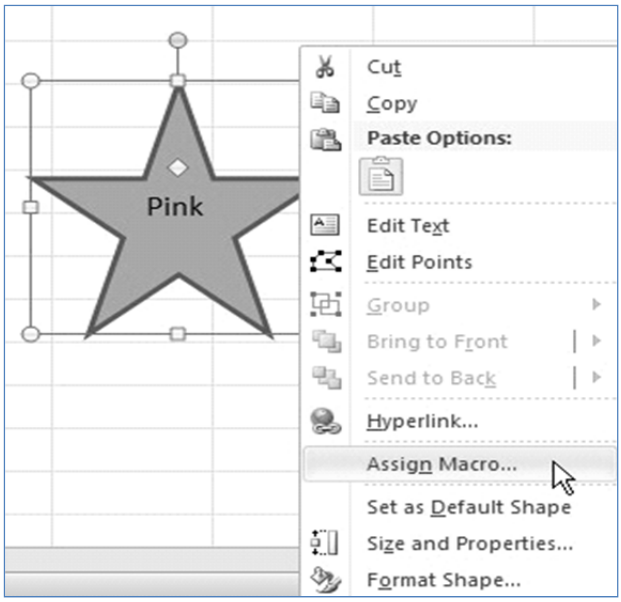


Fig. 2.4.8: Right click & select "Assign Macros"

- In the **Assign Macro dialog box** we select macro "*PERSONAL.XLSB!PinkHighlight*"

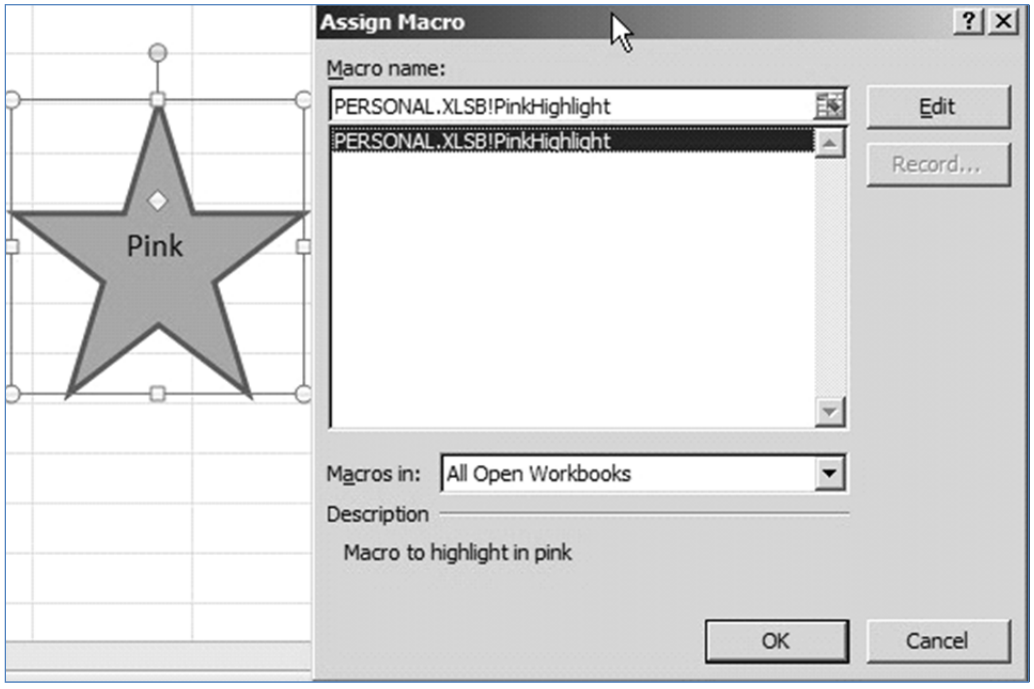


Fig. 2.4.9: Assign Macro Dialog Box

- **Macro is now assigned to the shape**, clicking on the shape *macro* in executed.

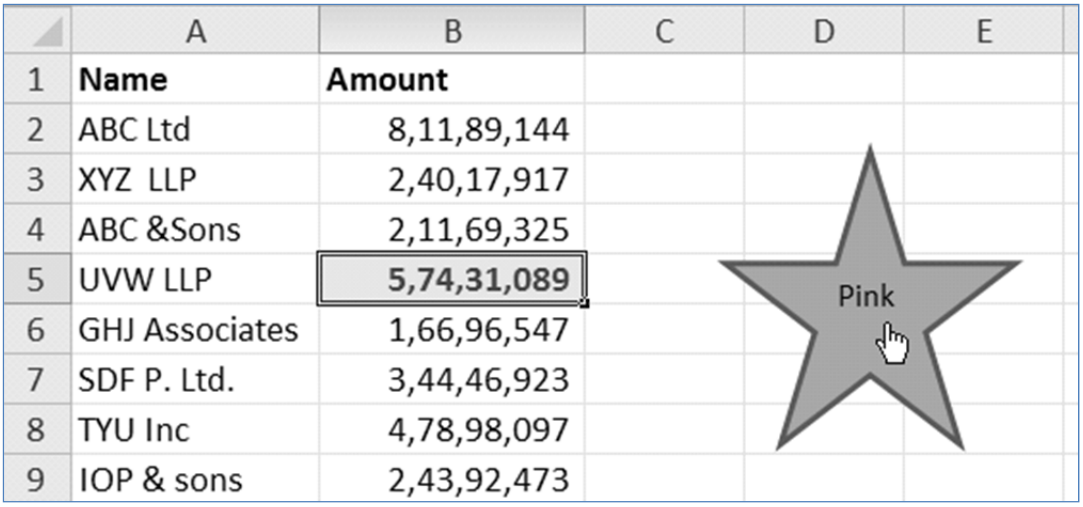


Fig. 2.4.10: Pink highlight Button on QAT

Gist: We have assigned a button in QAT to macro & also assigned a shape to it.

Commands Learnt: Assign a button

2.5 Absolute and Relative Referencing

Absolute reference mode. In absolute reference mode, Excel stores the absolute references for the cells that we're modifying.

Relative reference mode. In relative reference mode, Excel tracks how far we move from our starting position.

2.5.1 Relative Referencing

By default, Excel Macro Recorder records our absolute steps. Let's suppose we want to move from cell A1 to B1 after performing an action, we will press the Right Arrow key, but Excel will not record this key, instead it will only record the movement to cell B1. Now let's suppose we have recorded the actions and are to perform it in cell C1, when we run the Macro, a line of Macro will be executed and then cell B1 will be selected instead of selecting cell D1 (which is to the right of C1).

Excel records the movement to cell B1 instead of recording every action (keystroke). If we want Excel to record relatively, so that Excel moves to the right cell instead of selecting cell B1, we will have to enable Relative References. It can be switched on from the Macros menu just below the Start/Stop Recording option.

Case Study 2.3: We have to include a debtor list with our balance sheet auditee has given us a list of debtors with Name & City underneath it & Balance in the next cell as shown in Fig. 3.3.1 , however we want a list with 3 columns Name, City & Balance. To convert it we have to follow the boring routine of cut, paste & delete row for each debtor. We however want to automate this task.

	A	B
1	**Name**	**Amount**
2	ABC Ltd	8,11,89,144
3	New delhi	
4		
5	XYZ LLP	2,40,17,917
6	Chennai	
7		
8	ABC &Sons	2,11,69,325
9	Saharanpur	
10		
11	UVW LLP	5,74,31,089
12	Mumbai	
13		

Fig. 2.5.1: Debtors Data

Strategy:

We can automate this boring task using Macros in Excel

- We first insert a Column after A and name it **city**.
- Go to **Developer** > **Record Macro** a Record Macro Dialog Box appears as shown in Fig. 2.5.2

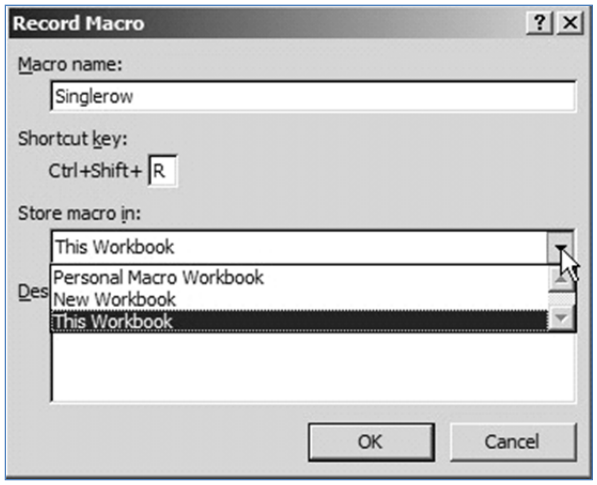


Fig. 2.5.2: Record Macro

- Select a name for the Macro "**Singlerow**",
- Assign a shortcut key "**Ctrl+Shift+R**" and
- Store the macro in" **this workbook** "since this macro would be used by us only once in this specific workbook.
- Click Ok
- Now the recording starts and all our steps would be recorded in the form of Macro.

- We perform the steps as shown in Fig. 2.5.3

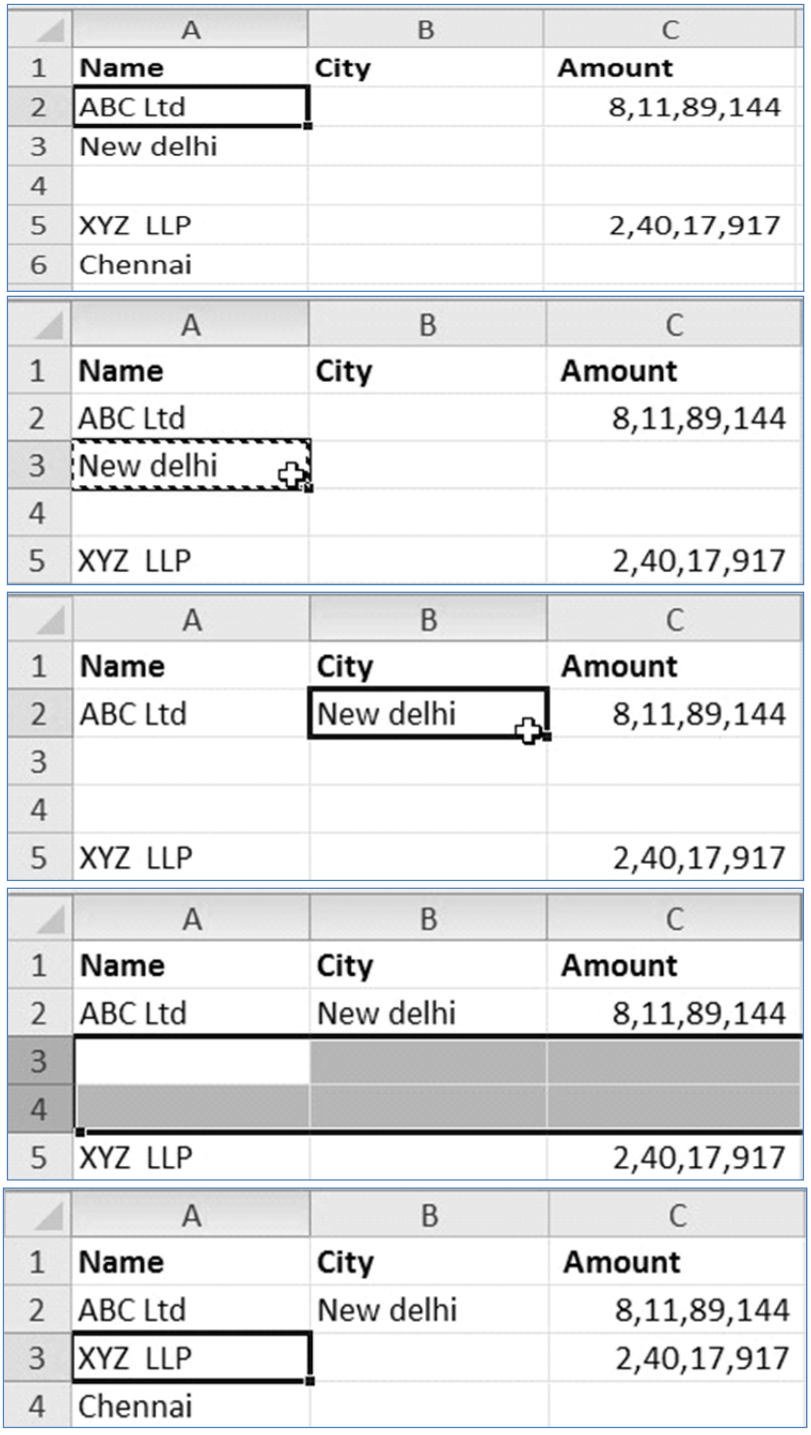


Fig. 2.5.3: Steps to record a Macro

- We start
  - *at Cell A2*
  - *Move to Cell A3.*
  - *Cut Cell A3 and paste to Cell B2.*
  - *Delete Rows 3 through 4.*
  - *Go to Cell A3*
  - *Stop Recording.*
- Our Macro is now recorded.
- We can **execute the macro** by pressing **Ctrl+Shift+R**.
- Let's try executing the Macro!!!!!!!!!
- Lo and Behold what has happened the company name from A3 has shifted to cell B2 and overwritten city.

	A	B	C
1	**Name**	**City**	**Amount**
2	ABC Ltd	XYZ LLP	8,11,89,144
3			
4	ABC &Sons		2,11,69,325
5	Saharanpur		

Fig. 2.5.4: Data destroyed

- Executing Macro once more and we see Excel eating our cells & **destroying Data**.
- What's happened?
- This has happened because by default macro records our actions literally and foolishly executes them ie it again goes to Cell A2, Move to Cell A3, Cut Cell A3 ie "XYZ LLP" and paste to Cell B2 overwriting city "New Delhi", Delete Rows 3 through 4, Go to Cell A3.
- And the result is absurdity we see above.
- Solution to the problem is in a **button on developer tab "Use Relative References"** as shown in Fig. 2.5.5.

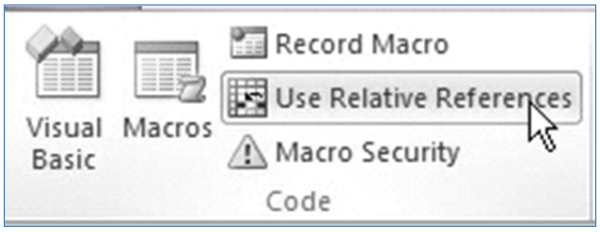


Fig. 2.5.5: Use Relative References

- Now before starting recording of the above macro we should have activated "Use Relative References" and proceeded to record the Macro.
- To remove the above Macro we go Developer > Macros.

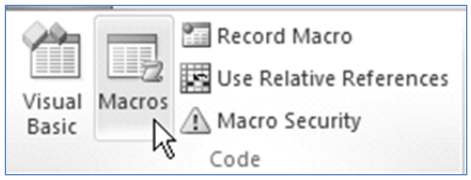


Fig. 2.5.6: Macro under developer

- We can see the Macro Dialog Box, Select macro Singlerow and click delete the Macro will be deleted.

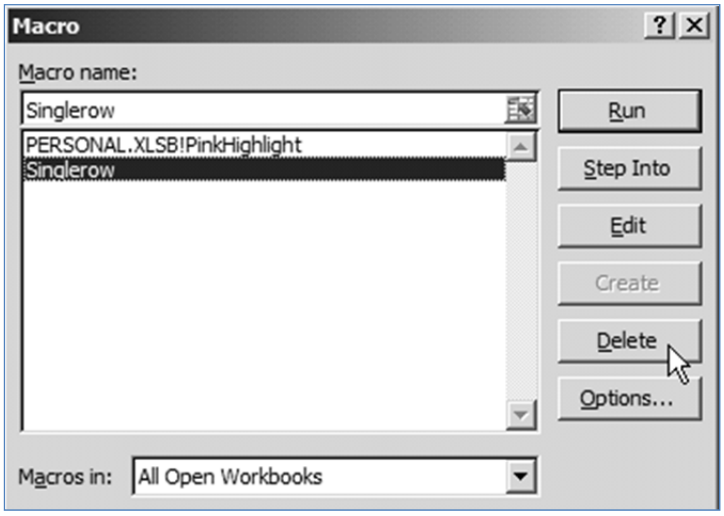


Fig. 2.5.7: Delete Macro

- To again start recording a Macro we first Activate "Use Relative References" and we see that the option has changed in color.
- Then we start recording Macros, to record Macro We repeat steps 9 enumerated above.
- Our Macro is now recorded.
- We try executing it & press Ctrl+Shift+R.
- The result is perfect something we desired.
- Basically by using "*Use Relative References*" we are telling Excel
  - *Move down one cell,*
  - *Cut the Value*
  - *Move one cell up, one to the right and paste the value.*

- *Move two cells left.*
- *Move Two cells Under select the two rows*
- *Delete the rows*
- *Move one cell below*

- We execute the macro a number of times and **our sheet gets into the desired shape** i.e. we have Name, City and Balance in a single Row as shown in Fig. 2.5.8.

	A	B	C
1	**Name**	**City**	**Amount**
2	ABC Ltd	New delhi	8,11,89,144
3	XYZ LLP	Chennai	2,40,17,917
4	ABC &Sons	Saharanpur	2,11,69,325
5	UVW LLP	Mumbai	5,74,31,089

Fig. 2.5.8: Resultant Sheet

Gist: We have arranged Name, City & Balance in single row using a Macro

Commands Learnt: Use Relative References in Macros

3.6 Summary

In this chapter we have learned it is easy to automate Excel to do repetitive things through Macros, we learned how to record a Macro. We have also learned to assign buttons to Macros

Finally, we learned to use relative References so that Macros don't do foolish things.

References

[1] Greg Harvey, 'Excel 2010 For Dummies', Wiley Publishing, Inc., Indianapolis, Indiana, 2010.

CHAPTER

3 APPLIED FINANCIAL ANALYSIS AND FORECASTING FINANCIAL STATEMENTS

LEARNING OBJECTIVES

- To understand Financial Analysis
- To understand Du-Pont Analysis
- To understand Leasing decisions
- To understand Financial Shenanigans
- To understand Equity Analysis
- To learn Chart creation
- Scenarios and Case Studies

3.1 Introduction

One of the most important features of excel is its number crunching ability. This is the reason it is used in almost every organization. Most Finance management or accounting packages allow us to export data into Excel format. Thus data analysis and reporting becomes an easier task.

Excel allows us to use various functions and even simple mathematical calculations can be performed for financial analysis, equity analysis, leasing decisions and the list goes on. However before we proceed, we need to know certain basic things about excel formulae:

3.1.1 Elements of a Formula

A Formula can have the following elements:

- Arithmetic Operators: These include symbols such as + (for addition) and / (for division)
- Conditional Operators: These include symbols such as > (greater than) ; <= (less than equalto); <> (not equal to)
- Cell References: These include references such as C4, =Sheet2!C4 (reference to other sheets)or references to other workbooks.
- Range References: These include references such as A1:A4, A1:D1, A1:D6
- Named References: These are named ranges or references created by the user to refer to aparticular range of cells. Ex: Range name “Data” referring to a range “A1:D100”
- Values or Strings: These are values such as 10 or10.5 (values) or “State wise Sales” (String).
- Strings are to be always enclosed in double quotes when used in a formula.

- Worksheet functions: A formula may consist of multiple functions and each function shall haveits own set of arguments and parameters.
- Parentheses: Every formula has its own set of arguments which are written in parentheses.Parentheses are also used to change the order of calculation.

Note: Excel colours the range addresses and the cells that you enter in a formula. This helps as a visual aid to spot the range used in the formula to either understand its working or to spot errors.

3.1.2 What is a Function?

A worksheet function is a built in tool that you use in a formula. Worksheet functions allow you to perform calculations or operations that would otherwise be too cumbersome or impossible altogether.

3.1.3 Arguments of a Function

A function may have:

- No arguments Ex: =TODAY()

TODAY function gives you system date which changes daily. This function doesn't require an argument.

- One argument Ex: =ABS(-4)

ABS function gives you absolute value of a number, number without its sign. This function accepts only one argument.

- A fixed number of arguments Ex: =MOD(100,3)

MOD function returns the remainder after a number is divided by a divisor. It mandatorily requires two arguments: number and divisor.

- Optional arguments

Ex: =INDEX (Salesdata, 5)

INDEX function returns value from a given data range based on row and column.

However in this function, "column number" is optional thus the function will work even without column number provided appropriate data has been selected.

3.1.4 Function Categories

Following function categories are available in excel:

Financial	Date & Time
Math & Trig	Statistical
Lookup & Reference	Database
Text	Logical
Information & Compatibility	User defined
Engineering	Cube

3.1.5 Show Formula Mode

You can often understand an unfamiliar workbook by displaying the formulas rather than the results of the formulas. To toggle the display of formulas, choose Formulas > Formula Auditing > Show Formulas.

You can also use Ctrl+` (~ the accent grave key, usually located above the Tab key) to toggle between Formula view and Normal view.

3.2 Financial Analysis

Usually potential investors analyze financial statements of companies they want to invest in. This is because financial statements reveal about the current and future financial condition of the company. Financial analysis often involves comparison between companies in the same industry, companies against external benchmarks and analysis of internal performance trends. Analysis also includes forecast based on historical performance. Before we move into the analytics we need to understand the balance sheet.

3.2.1 Understanding the balance sheet.

A Balance Sheet is a summary of the financial position of a business at a specific point in time, showing all assets, liabilities, and equity. It represents the accounting equation: assets equals liabilities plus shareholders' equity.

Assets are the means utilized to operate the company and are balanced by a company's financial obligations plus equity investment brought into the business and retained earnings. Here is a very simple example: For your new business, you want to buy a small office. You have ₹ 5 lakhs which you pay as down payment for office. Additional ₹ 20 lakhs you borrowed is your liability. (Assume you have borrowed from friends and relatives as interest-free loan.) as shown in Fig 3.2.1.

Financial Obligation	Value
Assets	
Office	25,00,000
Total Assets	25,00,000
Liabilities	
Loans Outstanding	20,00,000
Owner's Equity	5,00,000
Total Liabilities and Equity	25,00,000

Fig 3.2.1: Simple Balance sheet

A standard balance sheet comprises of following items as shown in Fig *3.2.2*:

Asset & Liability Categories	Examples and Explanation
Assets	
Current Assets	Examples include cash, marketable securities, accounts receivable and prepaid expenses.
Long term investments and other assets	Examples include investments in other companies.
Property, Plant and Equipment	Examples include fixed asset and machinery
Intangible assets	Examples include goodwill and patents
Total Assets	Total of current long term and intangible assets

Liabilities and Equity	
Current Liabilities	Examples include accounts payable and short term debt
Long term Liabilities	Long term debts
Total Liabilities	Total of current and long term liabilities
Equity	
Retained Earnings	Companies cumulative net income or loss
Owner Equity	Examples include owner's contribution and investments.
Total Equity	Total of earnings and owner equity
Total liabilities and equity	Total of liabilities and equity

Fig 3.2.2: Standard balance sheet items

3.2.2 Financial Ratios – An introduction

Financial analysts have a wide array of analysis tools at their disposal. Financial ratios are fundamental analytical tools for interpreting financial statements. Financial ratio analysis relates items in the financial statements in a manner that drives out performance information about the company. The following example shall better illustrate the significance of ratios.

Ex: Revenue of Company A is ₹ 50,000/- and Company B is ₹ 40,000/-. Which company is better?The obvious answer based on earnings is that Company A is better because it earns more. Now, suppose the capital employed by Company A is Rs 4, 00,000/- and Company B is ₹ 3, 00,000/-.

Based on this new information we shall derive **Profit as a % of Capital Employed** Company A = (50,000 / 4, 00,000)*100 = 12.50%

Company B = (40,000 / 3, 00,000)*100 = 13.33%

Company B is better than Company A based on the above ratio.

Thus ratios help us to convert figures into logical percentages which can then be compared with ratios from some other companies or a company's own past performance and appropriate conclusions can be drawn.

3.2.3 Various Ratios & Case Study

There are various types of ratios available to an analyst. In this section we shall cover a few of them with the help of the following case study as shown in given Figures:

	A	B	C	D	E	F
1	Balance sheet as on 31st March 2014					
2	**Liabilities**	**31-Mar-14**	**31-Mar-13**	**Assets**	**31-Mar-14**	**31-Mar-13**
3	**Share Capital**			**Fixed Assets Net**		
4	Equity	120	120	Gross Block	594	594
5	Preference	50	50	Less: Depreciation	(365)	(381)
6	**Reserves and Surplus**	215	180	**Intangible Assets**	15	11
7	**Secured Loans**			**Investments**	5	5
8	Debentures	50	50	**Current Assets**		
9	Loans/Advances	101	100	Cash in bank	73	70
10	**Unsecured Loans**	30	20	Receivables	189	185
11	**Current Liabilities**			Inventories	355	351
12	Sundry Creditors	330	340	Pre-paid Expenses	64	64
13	Provisions	69	69	**Misc Exp/Losses**	35	30
14	**Total Liabilities**	**965**	**929**	**Total Assets**	**965**	**929**
15						

Fig 3.2.3: Case Study – Balance Sheet

	A	B	C	D
1	Income statement for year ended 31st March 2014			
2	**Particulars**	**31-Mar-14**	**31-Mar-14**	**31-Mar-13**
3	**Net Sales**		**904**	**847**
4	**Cost Of Goods Sold**		(714)	(657)
5	Stocks	366		
6	Wages And Salaries	188		
7	Other Manufacturing Expenses	160		
8	**Gross Profit**		**190**	**190**
9	**Operating Expenses:**		(96)	(103)
10	Selling And Admin Expenses	71		
11	Depreciation	25		
12	**Operating Profit**		**94**	**87**
13	**Non-Operating Profit/Deficit**		**49**	**11**
14	**Profit Before Interest&Tax (EBIT)**		**143**	**98**
15	**Interest**		(33)	(26)
16	On Bank Borrowings/Loans	29		
17	Debentures	4		
18	**Profit Before Tax**		**110**	**72**
19	Tax		(58)	(36)
20	**Profit After Tax**		52	**36**
21	**Dividends:**		(17)	(12)
22	Equity	14		
23	Preference	3		
24	**Retained Earnings(Reserve & Surplus)**		**35**	**24**

Fig 3.2.4: Case Study – Income Statement

3.2.3.1 Liquidity Ratios

These ratios shows the ability of a company to pay its current financial obligations. Company should not be selling its assets at a loss to meet its financial obligations. In a worst scenario company will be forced into liquidation.

3.2.3.2 Current Ratio (CR)

- It is a measure of company's ability to meet its short term requirements.
- It indicates whether current liabilities are adequately covered by current assets.
- It measures safety margin available for short term creditors.
- CR = Current Assets / Current Liabilities
- If Net Working Capital is to be positive, CR > 1
- Higher ratio ensures firm does not face problems in meeting increased working capital requirements.
- Low ratio implies repeated withdrawals from bank to meet liquidity requirements.
- High CR as compared to other firms implies advantage of lower interest rates on loans.

	A	B	C
2	1	Current Ratio	1.71
3			=SUM(BS!E9:E12)/SUM(BS!B12:B13)
4			= Current Assets / Current Liabilities

Fig 3.2.5: Current Ratio

3.2.3.3 Acid Test / Quick Ratio (QR)

- Used to examine whether firm has adequate cash or cash equivalents to meet current obligations without resorting to liquidating non cash assets such as inventories
- Measures position of liquidity at a point of time
- QR = Quick Assets / Current Liabilities
- Quick assets = Current assets – (inventories + prepaid expenses)

  = 681–(355+64) = 262
- Current liabilities = 399
- QR = 262/399 = 0.66
- As a thumb rule ideal QR = 1; should not be less than 1

	A	B	C
6	2	Quick Ratio	0.66
7			=(SUM(BS!E9:E12)-(BS!E11+BS!E12))/SUM(BS!B12:B13)
8			=Quick Assets / Current Liabilities
9			=Current assets – (inventories + prepaid expenses) /Current Liabilities

Fig 3.2.6: Quick Ratio

3.2.3.4 Leverage / Solvency Ratios

These ratios show dependency of a firm on outside long term finance. They show long term financial solvency & measures firm's ability to pay interest & principle regularly when due. To assess extent to which the firm borrowed money vis-à-vis funds supplied by owners. Companies whose EBIT is less than Interest payments are risky

3.2.3.5 Debt – Equity Ratio

- It measures relative proportion of debt & equity in financing assets of a firm.
- Company can have good current ratio and liquidity position, however liquidity may have come from long term borrowed funds, the repayment of which along with interest will put liquidity under pressure.
- DER = Long term debt / Shareholders funds.
- Creditors would like this ratio to be low.
- Lower ratio implies larger credit cushion.
- Debt (loans) = Secure loans + Unsecure loans = 151+30=181
- Shareholders' funds = (equity + preference capital + reserves & surplus – fictitious assets & accumulated losses not written off) = 120+50+215 = 385
- DER = 181/385 = 0.47 = (0.47:1)
- Creditors are providing Rs 0.47 financing for each rupee provided by shareholders as shown in Fig 3.2.7.

	A	B	C
12	3	Debt - Equity Ratio	0.47
13			=(BS!B8+BS!B9+BS!B10)/(BS!B4+BS!B5+BS!B6)
14			
15			= Long term debt / Shareholders funds
16			
17			= (Secure loans + Unsecure loans)
18			(equity + preference capital + reserves & surplus) – (fictitious assets & accumulated losses not written off)

Fig 3.2.7: Debt-Equity Ratio

3.2.3.6 Debt – Total Fund Ratio

- DTF ratio= Long term debt / Total fund
- Debt (long term) = 181
- Total funds (debt + shareholders' funds) = 181+(170+215-35) = 531
- DTF ratio = 181/531 = 0.34
- 34% of the firms funds are debt (of various types) remaining 66% is financed by owners/ shareholders.
- Higher the debt - total funds ratio, greater the financial risk as shown in Fig 3.2.8.

	A	B	C
20	4	Debt - Total Fund Ratio	0.34
21			=SUM(BS!B8:B10)/(SUM(BS!B8:B10)+SUM(BS!B4:B6)-BS!E13)
22			=Long term debt / Total fund
23			= Long term debt / debt + shareholders' net funds

Fig 3.2.8: Debt Total Fund Ratio

3.2.3.7 Debt – Assets Ratio

- Debt - Assets ratio = Debt / Net assets
- Debt = 181
- Net assets (less fictitious assets & losses) = 930
- Ratio = 181/930 = 0.19
- 19% of the firm's assets are financed with debt (of various types).
- Shows coverage provided by the assets to total debt as shown In Fig 3.2.9.

	A	B	C
25	5	Debt - Asset Ratio	0.19
26			=SUM(BS!B8:B10)/(BS!E14-BS!E13)
27			
28			= Total Debt / Total Assets - Fictitious Assets & losses

Fig 3.2.9: Debt Asset Ratio

3.2.3.8 Interest Coverage Ratio

- This ratio shows ability of company to pay back long term loans along with interest or other charges from generation of profit from its operations
- Interest coverage ratio = EBIT / Debt interest

- EBIT = 143
- Interest = 29+4 = 33
- Ratio = 143/33=4.33
- EBIT should be 6 – 7 times of debt interest

	A	B	C
30	6	Interest Coverage Ratio	4.33
31			=PL!C14/(PL!B16+PL!B17)
32			=EBIT / Debt Interest

Fig 3.2.10: Interest Coverage Ratio

3.2.3.9 Liability Coverage Ratio (LCR)

- Calculated to determine time a company would take to pay off all its liabilities from internally generated funds.
- Assumes that liabilities will not be liquidated from additional borrowings or from sale of assets.
- LCR = internally generated funds / Total liabilities.
- Internally gen funds = Equity + Preference + Reserves & Surplus = 385
- Total liabilities = 965
- LCR = 385/965 = 0.399
- Firm will take 2.5 years (1/.399) to repay all its liabilities

	A	B	C
34	7	Liability Coverage Ratio (LCR)	0.399
35			=SUM(BS!B4:B6)/BS!B14
36			= internally generated funds / Total liabilities
37			= (Equity + Preference + Reserves & Surplus) / Total Liabilities

Fig 3.2.11: Liability Coverage Ratio

3.2.3.10 Turnover / Activity Ratios

Allows to examine whether total amount of each type of asset a company owns is reasonable, too high or too low in light of current and forecast operating needs. In order to purchase / acquire assets, companies need to borrow or obtain Capital from elsewhere:-

- More assets acquired implies high interest and low profits.
- Lesser assets implies operations not as efficient as possible.
- Activity turn over ratios used to assess efficiency with which company is utilizing its assets.
- Relates to level of activity represented by sales or cost of goods sold

3.2.3.11 Inventory turnover ratio

- Measures No of times inventory turned over in a year OR No of days of inventory held by company to sales
- Times Inventory turned over =

$$\frac{\text{Net sales}}{\text{Average inventory}} \text{ OR } \frac{\text{COGS}}{\text{Average stock}}.$$

- Inventory measured in days of sale = 365 x Average inventory

Net Sales

- Ratio = 904 / 355 = 2.54 times

This ratio indicates that inventory has turned over 2.54 times in a year.

- Inventory in days = (355 x 365) / 904 = 143.33 days

This ratio indicates that company has enough inventory to support 143 days (almost 5 months) sales as show in given Figures.

	A	B	C
41	8	Inventory Turn over ratio	
42	a	Times the inventory turned over	2.546
43			=PL!C3/BS!E11
44			= Net Sales
45			Average Inventory

Fig 3.2.12(A): Inventory Turnover Ratio

	A	B	C
47	b	Inventory measured in days of sale	143.34
48			=(365*BS!E11)/PL!C3
49			= 365 x Average Inventory / Net Sales

Fig 3.2.12(B): Inventory Turnover Ratio

3.2.3.12 Average collection period (ACP)

- It represents duration a company must wait after making sales, before it actually receives cash from its customers
- Average collection period = $\frac{\text{Average receivables}}{\text{Average sales per day}}$ OR $\frac{\text{Average receivables} \times 365}{\text{Sales}}$
- This ratio is used to assess credit policy of firm.
- It enables to effectively manage their credit.
- If ratio is too high it means company is facing difficulties in collecting debts.

- If the ratio is too low means the company is having restrictive credit policy
- ACP = (189 x 365) / 904 = 76 days

	A	B	C
51	9	Average Collection Period	76.31
52			=BS!E10*365/PL!C3
53			
54			=Average recievable x 365
55			Sales

Fig 3.2.13: Average Collection Period

3.2.3.13 Fixed assets turnover ratio (FATR)

- It helps to measure effective utilization of fixed assets by company.
- It is used to compare fixed assets utilization of two firms.
- High ratio usually indicates better asset utilization.
- Sometimes this ratio may be too high if assets are old or the ratio maybe too low if capital assets are procured recently.
- FATR = Net Sales (or COGS) / Fixed Assets = 904 / 229 = 3.95

	A	B	C
57	10	Fixed Assets Turn over ratio	3.95
58			=PL!C3/(BS!E4+BS!E5)
59			
60			=COGS / Fixed Assets

Fig 3.2.14: Fixed Assets Turnover Ratio

3.2.3.14 Profitability Ratios

These ratios indicate company's profitability in relation to other companies, internal comparison with its previous year's performance. They also indicate management effectiveness

3.2.3.15 Gross Profit ratio

- This ratio represents cost of production.
- It helps in understanding proportion of raw materials used and direct expenses incurred in overall production process.
- This ration reflects income being generated which can be apportioned by promoters
- This ratio also reflects efficiency of firm's operations as well as how products are priced
- GPMR = Gross profit/ Net sales

Gross Profit = Net sales - COGS = 904 - 714 = 190

GPMR = Gross Profit / Net sales = 190 / 904 = 0.21 = 21%

- Implies 79% (100-21%) of sales contribute towards direct expenses and raw material.

	A	B	C
64	11	Gross Profit Margin Ratio	21%
65			=PL!C8/PL!C3
66			= (Net sales - COGS) / Net Sales

Fig 3.2.15: Gross Profit Margin Ratio

3.2.3.16 Net Profit Ratio

- It takes into account not only cost of production but also administrative expenses like staff salary, selling & distribution overheads.
- It represents surplus of gross profit after meeting expenses.
- Net profit is usually appropriated to meet tax liability, dividend payments and to retain part in business.
- NPMR = Net profit (Profit after tax)/ Net sales = 52 / 904 = 5.7 %
- This implies that every ₹ 100/- of sales, ₹ 5.7 /- earned as profit

	A	B	C
68	12	Net Profit Margin Ratio	5.75%
69			=PL!C20/PL!C3
70			= Net profit / Net Sales

Fig 3.2.16: Net Profit Margin Ratio

3.2.3.17 Return on Investment

- This ratio indicates efficiency with which company used its capital (Equity as well as debt)
- This ratio takes into consideration overall returns of the company assuming company has not taken any debt.
- It gives overall returns including adjustments of earnings for financial leveraging.
- It enables one to check whether return made on investment is better than other alternatives available.
- RoI = EBIT x 100 / Capital Employed
- EBIT = 143
- Capital Employed = 566 ((120 + 50 + 215 + 181) – (0 – 0))

  (Equity + Preference + Reserve & Surplus + Debt) – (Fictitious assets + Non-operating assets)

- ROI = 143 / 566 x 100 = 25.26 %
- The company has earned a profit of ₹ 25.26 paisa on every ₹ 100 reinvested as shown in Fig 3.2.17

	A	B	C
72	13	Return on Investment	25.26501767
73			=PL!C14 * 100/SUM(BS!B4:B10)
74			= EBIT x 100 / Capital Employed
75			
76			= EBIT x 100
77			(equity + preference capital + reserves & surplus + Debt) – (fictitious assets & non operating investments)

Fig 3.2.17: Return on Investment

3.2.3.18 Valuation Ratios

Earnings per share (EPS)

- It represents total earnings of a company available for distribution among equity shareholders. Evaluates performance of company shares over a period of time
- EPS = Net profit available for equity shareholders / No of Equity shares
- EPS alone should not be basis of decision making with respect to purchase of any company share
- Faulty reasons of High EPS
- Less No of Equity shares
- Investment in risky ventures

Price Earnings (PE) Multiple

- It is the simplest method of comparing different stocks at a point of time to make investment decisions
- As a layman, this is the price being paid for buying one rupee of earning of a company

  ex: If PE of Infosys share is Rs 9/- it means we are paying to the market a price of 9 for every Rs 1/- earning of the company
- PE Ratio = Market Price per share/ EPS

Price Earnings Growth (PEG) Multiple

- An extension of PE which also takes into account growth rate of the company PEG Multiple = PE / Growth

	Company A	Company B
Market Price	200	200
EPS	10	20
Growth rate	5%	2%
PE Ratio	20 (200/10)	10 (100 / 20)
PEG Multiple	4 (20 / 5)	5 (10 / 2)

- Company A overvalued.
- Company B overpriced wrt growth potential

With this we complete Ratio analysis. We shall now learn how to carry out Du Pont Analysis.

3.3 Du Pont Analysis

Du Pont Analysis helps to break down the Return on Equity (RoE).

3.3.1 What is ROE?

Return on Equity is a financial ratio that shows you how well the management has created value for shareholders. ROE is made up of two numbers, net income and shareholders' equity.

ROE = Net Income/Shareholders Equity

A high ROE generally means that the rate of return on shareholders' equity is going up and that the company is doing a good job of growing profits without adding new equity into the business.

A high and consistent ROE can signal that the company has a competitive advantage over its competitors.

3.3.2 Introducing the DuPont Analysis

Du Pont Analysis dissects the ROE to tell you how the company is achieving its ROE. These are the three questions that the DuPont analysis can help you answer:

- Is the company increasing margins?
- Is the inventory turnover increasing?
- Is leverage being used?

3.3.3 Three Step DuPont Analysis Model

ROE = (Net Profit Margin x (Asset Turnover) x (Equity Multiplier)

- Net profit margin shows operating efficiency
- Asset turnover shows asset utilization efficiency
- Equity multiplier shows financial leverage; where

Net Profit Margin = Net Income/Sales

Asset Turnover = Sales/Total Assets

Equity Multiplier = Total Assets/Shareholders Equity

When we multiply these three factors, Sales and Total Assets cancel each other out resulting in ROE as shown in Fig 4.3.1.

ROE = (Net Income/Sales) x (Sales/Total Assets) x (Total Assets/Shareholders Equity)

	A	B	C
1	**Company A**		
2	Revenue	1,300.00	
3	EBT	112.65	
4	EBIT	121.88	
5	Interest Expense	9.23	
6	Income Tax	41.65	
7	Net Income	70.99	
8	Total Assets	737.05	
9	Shareholders Equity	449.09	
10			
11	**Three-Step DuPont Model:**		
12	**Net Profit Margin** (Net Income ÷ Sales)	5.5%	=B6/B1
13	**Asset Turnover** (Sales ÷ Total Assets)	1.76	=B1/B7
14	**Equity Multiplier** (Total Assets ÷ Shareholders Equity)	1.64	=B7/B8
15	***Return on Equity***	**15.8%**	=B11*B12*B13

Fig 3.3.1: Return on Equity

3.4 Leasing

Leasing is a common method for financing property, facilities, and equipment. Leases are contracts between an asset's owner (called the lessor) and the user (the lessee). A lease gives the lessee the right to use the asset in exchange for periodic payments to the lessor. For defining operating leases of equipment, the lessor is often a manufacturer that leases its own products to the lessee (sales-type leases). Sometimes the lessor is an independent leasing company that buys from the manufacturer and leases it to the lessee (direct leases). In this case, the lessor may borrow funds from creditors in order to buy the equipment from the manufacturer (leveraged leases). At other times, the owner of an asset sells it to another firm and immediately leases it back (sale and lease-back leases). This allows the original owner to raise cash for immediate needs and still retain the use of the asset while the lease is paid off.

Lease terms vary. Operating leases are generally for shorter durations than the useful life of the asset leased and, for this reason, they are not fully amortized; the lessor does not recover the asset's full cost.

The lessor reacquires possession of the asset at the expiration of the operating lease and can lease it again for further use. Financial leases, on the other hand, are fully amortized. A lessee can cancel an operating lease before its expiration date. However, a lessee cannot cancel a financial lease and must make all payments or face bankruptcy. Leases also differ in requirements for the lessee to insure and maintain the leased asset and the right of the lessee to renew on the expiration of the lease.

Leasing a car for a day or week during a vacation trip is an example of a short-term lease. Leasing trucks, factory machinery, computers, or airplanes for a number of years are examples of long-term financial leases that are involved in capital budgeting. Such leases are the most common method of financing equipment.

For the lessee, the choices are to buy or to lease. For the lessor, the problem is to identify the highest rental rate that would be acceptable to a lessee.

The following case study is for a long-term financial lease of operating equipment from the standpoint of the lessee. It shows how to identify whether it is better for a company to lease or buy operating equipment. Note the treatment of depreciation, the firm's cost of capital or discount rate, the lessor's rental rate, and taxes. As the owner of the asset leased, the lessor gets a tax shield for the asset's depreciation. The lessee can claim the lease payments as an operating expense. The benefits generated by the equipment and such expenses as maintenance, repair, and insurance are assumed to be the same regardless of whether the equipment is leased or purchased.

Example 1: Suppose we want to buy a server and its cost is ₹ 1, 75,000/- and lease payments are ₹ 45,000/- with annual rate 8%

	A	B	C	D
1	**Cost of Server**	175,000		
2	**Annual lease**	45,000		
3	**Annual interest rate**	8%		
4				
5	**Year**	**Purchase**	**Lease**	**NPV**
6	0	175,000	45,000	45,000.00
7	1		45,000	41,666.67
8	2		45,000	38,580.25
9	3		45,000	35,722.45
10		175,000	160,969.36	160,969.36
11				
12	What to conclude?	Lease		

Fig 3.4.1: Leasing Example

	A	B	C	D
1	**Cost of Server**	175000		
2	**Annual lease**	45000		
3	**Annual interest rate**	0.08		
4				
5	**Year**	**Purchase**	**Lease**	**NPV**
6	0	=B1	=B2	=C6/(1+$B$3)^A6
7	1		=C6	=C7/(1+$B$3)^A7
8	2		=C7	=C8/(1+$B$3)^A8
9	3		=C8	=C9/(1+$B$3)^A9
10		=SUM(B6:B9)	=C6+NPV(B3,C7:C9)	=SUM(D6:D9)
11				
12	What to conclude?	=IF(B10<C10,"Purchase","Lease")		

Fig 3.4.2: Leasing Example – Formula mode

Example 2:

A company is considering to acquire an additional machinery It has 2 options:

Option 1: To purchase machinery for Rs 2200000

Option 2: To lease the machinery for 3 years for ₹ 725000 as annual lease. The agreement also requires an additional payment Rs 600000 at the end of 3rd year

Annual Operating Costs (excluding depreciation /lease rent of machinery) are estimated at ₹ 900000 with an additional cost ₹ 100000 for training cost at the beginning of the year. These costs are to be borne by lessee. The Company will borrow at 16% interest to finance the acquisition. The Machinery under review will be worth Rs 10 lacs at the end of 3 years. Repayments are to be made as follows:

Year end	Principal	Interest
1	5,00,000	3,52,000
2	8,50,000	2,72,000
3	8,50,000	1,36,000

The Company uses SLM to depreciate the assets & pays tax @ 50%.

Which alternative is better?

For solving this example we shall create two tables. One table will be used to evaluate NPV under the leasing option and second table will be used to evaluate NPV under the Purchase option.

To recreate these tables use the formula as displayed in Table with Show formula mode enabled as shown in Fig 3.4.3.

	A	B	C	D	E	F	G	H
1	Present Value of Cash Outflows under Leasing Alternative							
2								
3	Payment under Lease Contract				Tax Shield @ 50 % on lease Payment	Net Cash Outflow	PV Factor @ 8%	Total PV
4	Year	Lease Rent	Lump Sum Payment	Total				
5	1	725,000	-	725,000	362,500	362,500	0.926	335,648
6	2	725,000	-	725,000	362,500	362,500	0.857	310,785
7	3	725,000	600,000	1,325,000	662,500	662,500	0.794	525,914
8								1,172,347
9								or
10							NPV	1,172,347

Fig 3.4.3: Leasing Example 2: Evaluating Leasing Option

	A	B	C	D	E	F	G	H
1	Present Value of Cash Outflows under Leasing Alternative							
2								
3	Payment under Lease Contract				Tax Shield @ 50 % on lease Payment	Net Cash Outflow	PV Factor @ 8%	Total PV
4	Year	Lease Rent	Lump Sum Payment	Total				
5	1	725000	0	=SUM(B5:C5)	=D5*0.5	=D5-E5	=1/1.08	=F5*G5
6	2	725000	0	=SUM(B6:C6)	=D6*0.5	=D6-E6	=G5/1.08	=F6*G6
7	3	725000	600000	=SUM(B7:C7)	=D7*0.5	=D7-E7	=G6/1.08	=F7*G7
8								=SUM(H5:H7)
9								or
10							NPV	=NPV(8%,F5:F7)

Fig 3.4.4: Leasing Example 2: Evaluating Leasing Option (Formula-Mode)

	A	B	C	D	E	F	G	H	I	J
12	Present Value of Cash Outflows under buying /Borrowing Alternative									
13										
14	Installment Payment			Scrap value of machinery	Total	Tax Advantage on		Net Cash Outflow	PV Factor @ 8%	Total PV
15	Year	Principal	Interest			Interest Payment	Depreciation			
16	1	500,000	352,000		852,000	176,000	200,000	476,000	0.926	440,741
17	2	850,000	272,000		1,122,000	136,000	200,000	786,000	0.857	673,868
18	3	850,000	136,000	-1,000,000	-14,000	68,000	200,000	-282,000	0.794	-223,861
19										890,748
20										or
21									NPV	890,748
22										

Fig 3.4.5: Leasing Example 2: Evaluating Purchase Option

	A	B	C	D	E	F	G	H	I	J
12	Present Value of Cash Outflows under buying /Borrowing Alternative									
13										
14	Installment Payment			Scrap value of machine	Total	Tax Advantage on		Net Cash Outflow	PV Factor @ 8%	Total PV
15	Year	Principal	Interest			Interest Payment	Depreciation			
16	1	500000	352000		=SUM(B16:D16)	=C16*0.5	200000	=E16-F16-G16	=1/1.08	=H16*I16
17	2	850000	272000		=SUM(B17:D17)	=C17*0.5	200000	=E17-F17-G17	=I16/1.08	=H17*I17
18	3	850000	136000	-1000000	=SUM(B18:D18)	=C18*0.5	200000	=E18-F18-G18	=I17/1.08	=H18*I18
19										=SUM(J16:J18)
20										or
21									NPV	=NPV(8%,H16:H18)
22										

Fig 3.4.6: Leasing Example 2: Evaluating Purchase Option (Formula-Mode)

Under the leasing option we have made sure that tax has been considered and subtracted from the cash outflows. Then we apply the PV factor of 8% (16% x 50% tax rate) to the net cashflow.

Under the purchase option we have subtracted tax component from the interest to ensure that we account for the tax benefit on the same. Also we subtract depreciation of 2,00,000/-

(Cost – Salvage value)/Life = [(22,00,000 – 10,00,000) / 3] * 50% tax rate

From above figures it is evident that NPV under the purchase option is lower than NPV under lease, thus purchasing the machinery is a better choice.

3.5 Financial Shenanigans

Financial shenanigans are actions or omissions (tricks) intended to hide or distort the real financial performance or financial condition of an entity. They range from minor deceptions to more serious misapplications of accounting principles.

Let us see one of the most famous (for all the wrong reasons) case of financial fraud and how it could have been detected by a simple analysis of Ratios and Charts

3.5.1 Enron case

The table shows Enron sales figures for five years in a row. We shall first calculate the GP and NP ratio and then create a chart based on the same to compare their growth trend as shown given figures 4.5.1.

	A	B	C	D	E	F
1	**Year**	**1996**	**1997**	**1998**	**1999**	**2000**
2	**Sales (million $)**	13,289	20,273	31,260	40,112	100,789
3	**Gross Profit**	2,811	2,962	4,879	5,351	6,272
4	**GP %**	21.2%	14.6%	15.6%	13.3%	6.2%
5	**Net Profit**	584	105	703	893	979
6	**NP %**	4.4%	0.5%	2.2%	2.2%	1.0%
7	**Fortune 500 ranking**	94	57	27	18	7

Fig 3.5.1: Enron Annual Comparative

	A	B	C	D	E	F
1	**Year**	**1996**	**1997**	**1998**	**1999**	**2000**
2	**Sales (million $)**	13289	20273	31260	40112	100789
3	**Gross Profit**	2811	2962	4879	5351	6272
4	**GP %**	=B3/B2	=C3/C2	=D3/D2	=E3/E2	=F3/F2
5	**Net Profit**	584	105	703	893	979
6	**NP %**	=B5/B2	=C5/C2	=D5/D2	=E5/E2	=F5/F2
7	**Fortune 500 ranking**	94	57	27	18	7

Fig 3.5.2 Enron Annual Comparative – Show formula mode

3.5.2 Chart preparation Steps:

(Note: Certain formatting options shown below are more or less same for all the charts)

1. Select Range A2:F2

	A	B	C	D	E	F
1	**Year**	**1996**	**1997**	**1998**	**1999**	**2000**
2	**Sales (million $)**	13,289	20,273	31,260	40,112	100,789
3	**Gross Profit**	2,811	2,962	4,879	5,351	6,272
4	**GP %**	21.2%	14.6%	15.6%	13.3%	6.2%
5	**Net Profit**	584	105	703	893	979
6	**NP %**	4.4%	0.5%	2.2%	2.2%	1.0%
7	**Fortune 500 ranking**	94	57	27	18	7

Fig 3.5.3: Select range

2. Go to Insert Tab > Charts Section > Line Chart > 2D Line Chart > First option

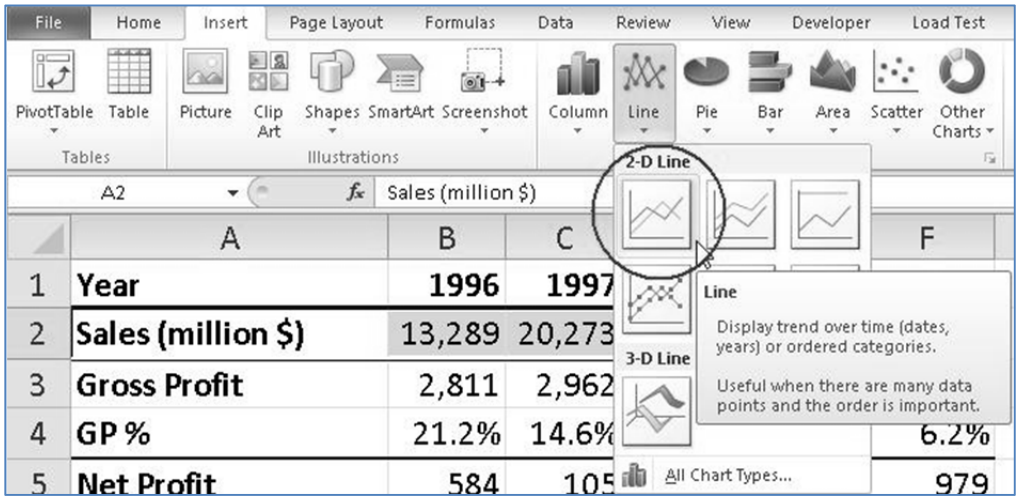


Fig 3.5.4: Chart selection

3. We get a chart which looks like the following image, click on this chart to enable Contextual Chart Tools. This will show three tabs: Design, Layout and Format tab

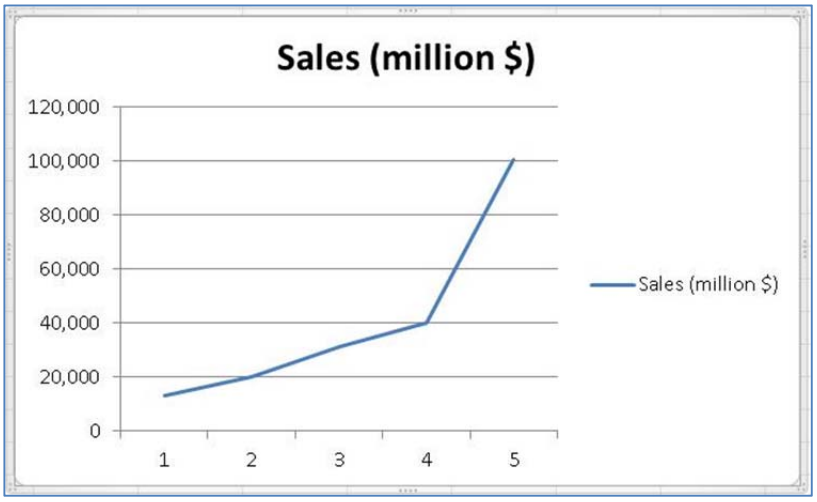


Fig 3.5.5: Chart image

4. Goto Design Tab > Select Data button

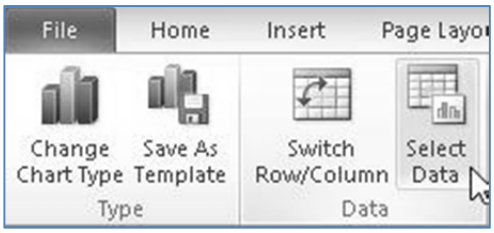


Fig 4.5.6: Select Data Button

5. We shall get the following window, click on Edit Button of Horizontal Axis labels

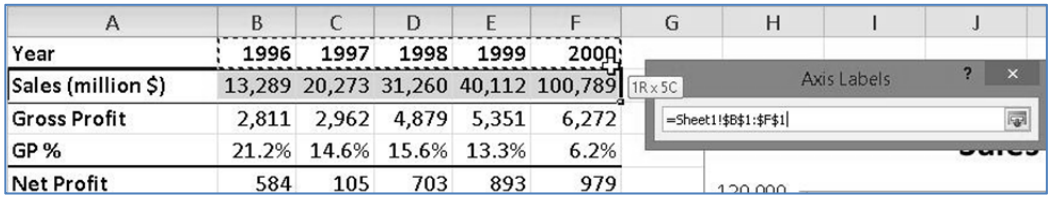


Fig 3.5.7: Click on Edit Button

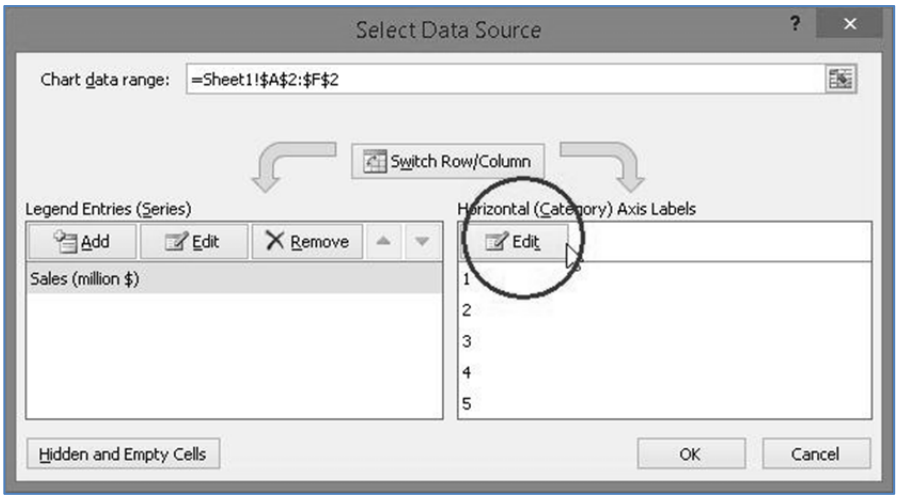


Fig 3.5.8: Select Data Source

6. We get "Axis Label Range" Selection Window. Select Range B1:F1. Click OK. X – Axis will now have years instead of numbers 1 to 5.

7. Left click on Chart Title and Type "Enron Growth". The type value appears in the formula bar. After typing, press Enter to save the chart title.

8. Goto Layout tab > Data labels > Above

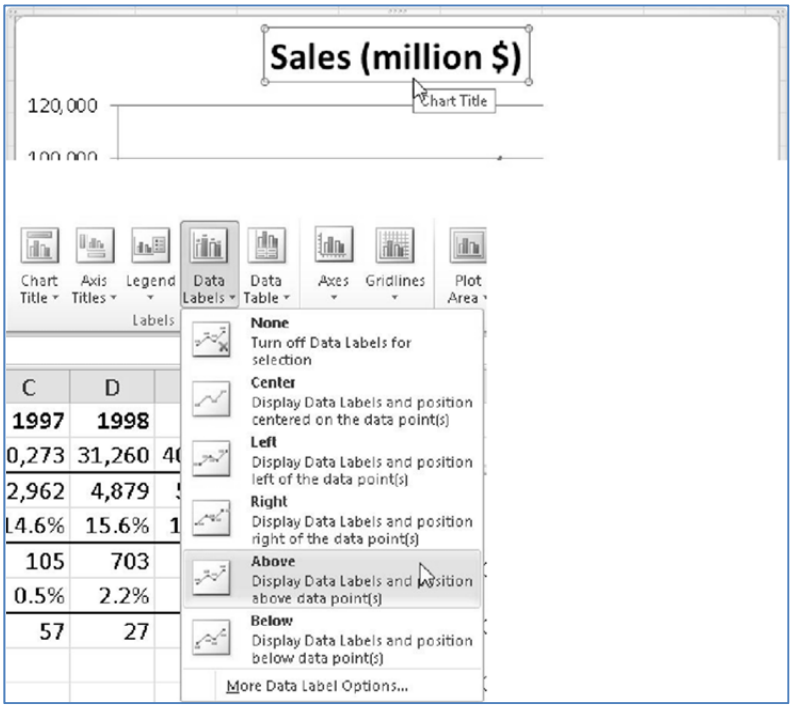


Fig 3.5.9: Go to Layout Tab

9. Goto Layout tab > Gridlines > Primary horizontal gridlines > None

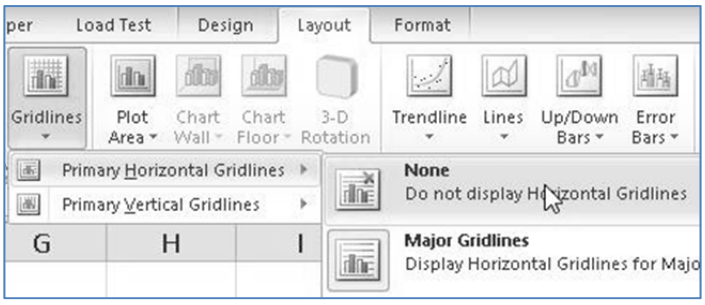


Fig 3.5.10: Select None

10. Goto Layout tab > Legend > Show Legend at bottom. This will shift the chart index and place it below the chart.

Fig 3.5.11: Select Legend

11. Left click on the plotted sales line such that the data points get selected.

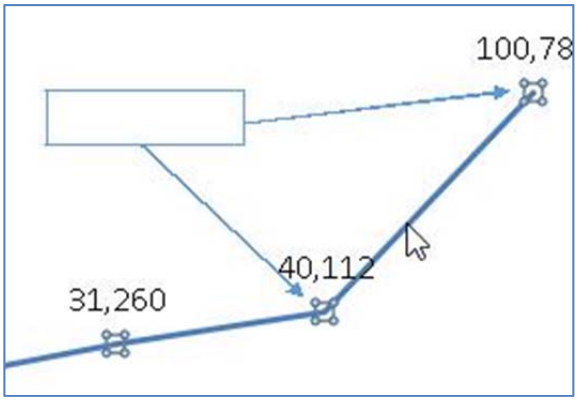


Fig 3.5.12: Data Point

3.5.3 Data points

12. Goto Layout Tab > Current Selection Section > Format Selection Button

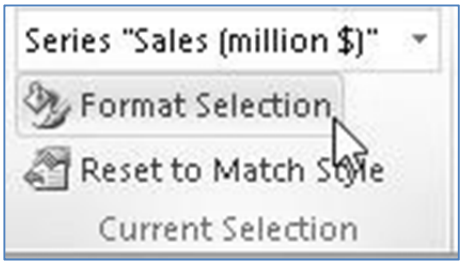


Fig 3.5.13: Format Selection

13. We get a Format Data Series window. Select Marker Options. Under Marker Type, Select Built-in option. Then Close the window.

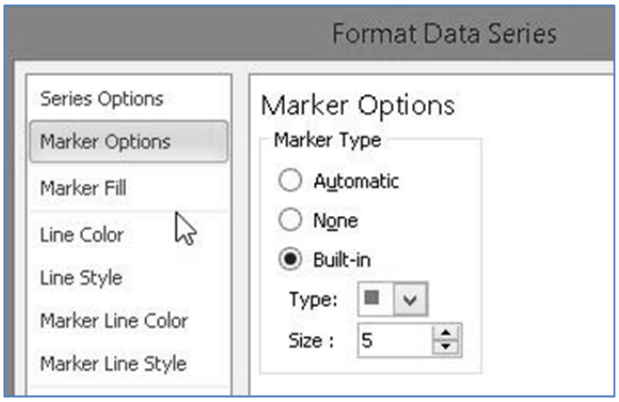


Fig 3.5.14: Select Built-in

14. On the design tab we have various chart styles. We can select any one from the given options or create a custom style.

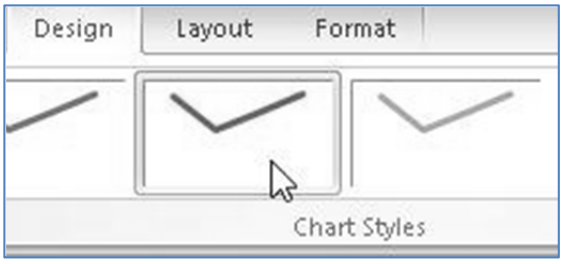


Fig 3.5.15: Select Design tab

15. As a result of the above settings we get the following chart. The following chart clearly shows the sudden increase in the revenues. The sudden increase shown in the chart itself is a sufficient sign to alert any person who is analyzing the revenues of the company.

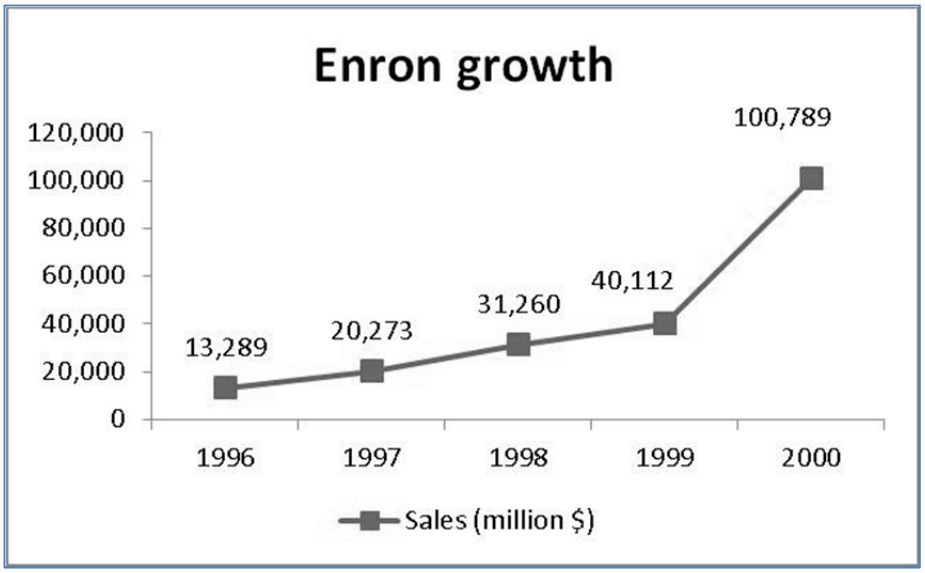


Fig 3.5.16: Enron Growth Chart

Chart preparation Steps:

1. Select Range A4:F4, then keeping the Ctrl key pressed, select Range A6:F6 Thus we have selected two non-continuous ranges.

	A	B	C	D	E	F
1	Year	1996	1997	1998	1999	2000
2	Sales (million $)	13,289	20,273	31,260	40,112	100,789
3	Gross Profit	2,811	2,962	4,879	5,351	6,272
4	GP %	21.2%	14.6%	15.6%	13.3%	6.2%
5	Net Profit	584	105	703	893	979
6	NP %	4.4%	0.5%	2.2%	2.2%	1.0%
7	Fortune 500 ranking	94	57	27	18	7

Fig 3.5.17: Select two non-continuous ranges

2. Goto Insert Tab > Charts Section > Line Chart > 2D Line Chart > First option

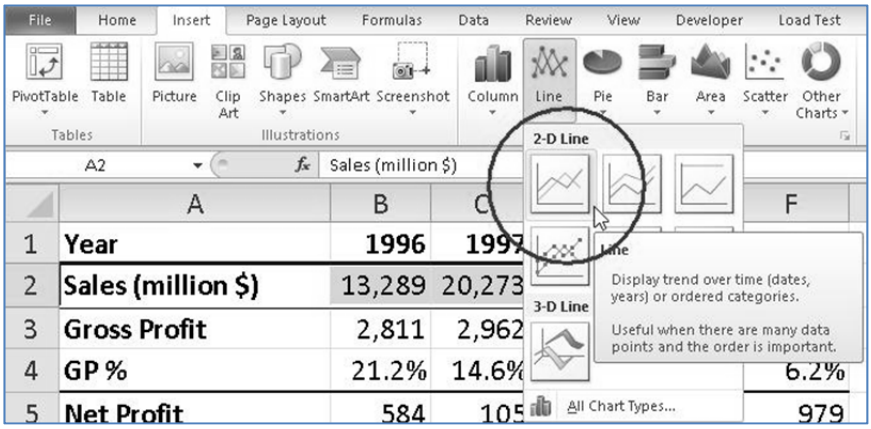


Fig 3.5.18: Select 2D Line Chart

3. As explained in the previous chart

   (a) Enable Data labels.

   (b) Change Legend position

   (c) Add Data Markers.

4. As a result of the above formatting we shall get the following chart.

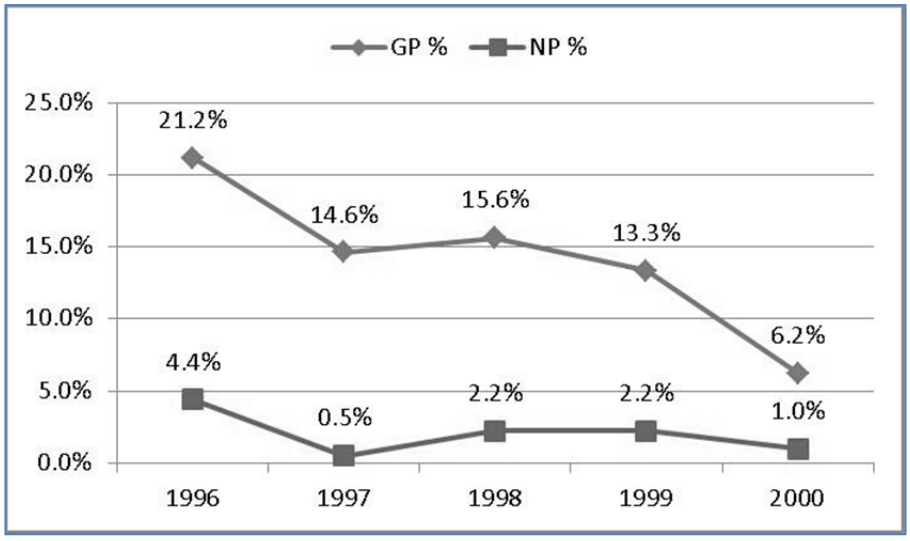


Fig 3.5.19: Profit Ratio trend

From both the charts it is very evident with some basic charts, trend analysis and due diligence it was very much possible to understand that there was something really wrong with the company's financial data. It wouldn't be very difficult for a learned investor and a good auditor to recognize the anomalies in data.

3.6 Equity Research

3.6.1 What is Equity Research

Equity research is a study of equities or stocks for the purpose of investments. Equities or common stock comprises a big chunk in any company's capital and shareholders need to know whether to stay invested in the company or sale the shares and come out. As an individual, it is time consuming to do equity research – that is to study the company, its financial statements, products, management and take a decision about investment. Thus there are people working in research companies whose job is to do equity research and recommend companies for investment.

3.6.2 Valuation Methods

Valuation models use time value of money principles or simpler market principles to value assets, stock and shares or the perceived value of future benefits. Valuation by different methods does not necessarily produce the same answers and the market employs a wide variety of methods. The purpose of this chapter is to set out some of the basic mathematics for valuation.

Companies can be valued from several different angles: for example a liquidation value can be very different from a going concern. Alternatively, a stream of dividends is very different from cash flow although a long-term investor may view a company purely for its income potential. Similarly it depends on whether you are buying or selling. Since a flow of future benefits represents a forecast, the financial model has to show all the inputs to enable risk analysis of the key variables. The valuation is very likely a range rather than a single point which should be compared by method and with other companies within a peer group.

Methods fall into these main categories:

- Asset and adjusted asset valuations;
- Dividend models;
- Market methods;
- Free cash valuation.

3.6.3 Market methods

Stock market and earnings methods using share prices, earnings per share and price / earnings per share (P/E) are traditional ways of forming benchmarks or comparisons. The mathematics are very simple and spreadsheets are not really required, although the benchmark is often needed for comparison and price ranges. Whilst the pricing reflects market sentiment about particular stocks which can rise on takeover speculation or fall during a crash, it does represent a fair price between a willing buyer and seller. The basic calculation is:

*Market value = no of shares * share price*

The model needs:

- Earnings after tax and interest (NPAT)
- Number of shares
- Calculate earnings per share (EPS)
- Price earnings per share (P/E) ratio
- Current market price of share / EPS

The valuation can be derived from either:

- P/E * earnings per share = share price
- Share price * no of shares = market value

The net income and number of shares is on the Data sheet and from this the earnings per share can be calculated as approximately 0.07. The current share price is 5.0 so the price / earnings per share ratio is 71.43.

The valuation is therefore P/E * Net earnings: 71.43 * 3.50 = 250.

The data table in Figure 14.3 shows the sensitivity to the P/E ratio. This is a high figure and there are perhaps some problems relating to the variables used. The formula is:

*Value of equity = sustainable earnings * approx P/E ratio + value of non-operating assets*

3.6.4 Dividend Growth model

Suppose Big D, Inc. just paid a dividend of ₹ 30. It is expected to increase its dividend by 2% per year. If the market requires a return of 15% on assets of this risk, how much should the stock be selling for?

$$P_0 = \frac{D_0 (1 + g)}{R - g} = \frac{D_1}{R - g}$$

P0 = D0(1+g)/(R-g)

P0 = 30 * (1+.02) / (.15 - .02) = Rs 235. 2

	A	B	C
1	Dividend Growth Model ==> $P_0 = D_0*(1+g)/(R-g) = D_1/(R-g)$		
2			
3	Current Stock Price =	P_0	=C5/(C7-C6)
4	Current Dividend (now) =	D_0	0.5
5	Dividend in 1 year =	D_1	=C4*(1+C6)
6	Constant Growth Rate =	g	0.02
7	Annual Required Rate of Return =	R	0.15
8			
9	One cell formula ->		=C4*(1+C6)/(C7-C6)

Fig 3.6.1: Dividend Growth Model Example

Suppose ABC Ltd. is expected to pay a ₹ 120 dividend in one year. If the dividend is expected to grow at 5% per year and the required return is 20%, what is the price?

P0 = D1/(R-g)

P0 = 120 / (.2 - .05) = ₹ 800/-

	A	B	C
1	Dividend Growth Model ==> $P_0 = D_0*(1+g)/(R-g) = D_1/(R-g)$		
2			
3	Dividend in 1 year =	D_1	120
4	Constant Growth Rate =	g	0.05
5	Annual Required Rate of Return =	R	0.2
6	Current Stock Price =	P_0	=C3/(C5-C4)

Fig 3.6.2: Dividend Growth Model Example

3.6.5 Stock Price Sensitivity Analysis – growth percentage

We shall perform a sensitivity analysis to see how the change in growth percentage affects Market price of shares.

In this example we have Expected dividend as ₹ 2; Required Rate as 20%

Using the formula learnt above we shall create a table by entering formula in Cell B6

After entering the formula double click on the fill handle in Cell B6 so the entire column will be filled with stock price for the respective growth percentage in the table.

	A	B	C	D	E
1	Current Stock Price Increases as the Constant Growth Rate Increases, D1 = 2 and R = 20.00%				
2	D_1	2			
3	R	0.2			
4					
5	Constant Growth Rate	Current Stock Price			
6	0%	=$B$2/($B$3-A6)			
7	1%				
8	2%				
9	3%				

Fig 3.6.3: Growth Percentage

Chart preparation Steps:

1. Select Range A5:B25.
2. Goto Insert Tab > Charts Section > Scatter Chart > Select the chart as show below.

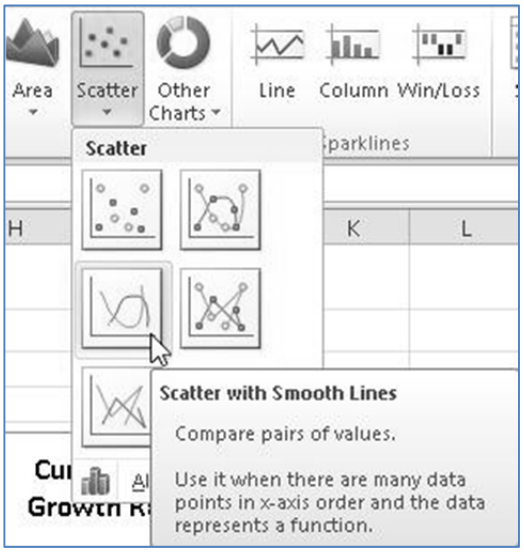


Fig 3.6.4: Select Scatter Chart

3. Format the chart as explained in previous example.

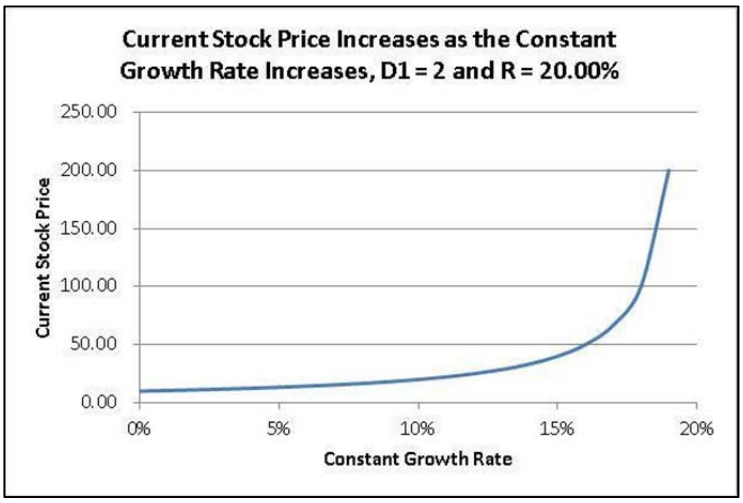


Fig 3.6.5: Stock price sensitivity to dividend growth

This chart clearly displays how the price increase with growth in dividend.

3.6.6 Stock Price Sensitivity Analysis – expected return

We shall perform a sensitivity analysis to see how the change in expected return affects Market price of shares.

In this example we have Expected dividend as ₹ 2; growth rate is 5%

Using the formula learnt above we shall create a table by entering formula in Cell B6

After entering the formula double click on the fill handle in Cell B6 so the entire column will be filled with stock price for the respective growth percentage in the table.

	A	B	C	D
1	Current Stock Price Decreases as the Rate Of Return Increases, D1 = 2 and g = 5.00%			
2	D_1	2		
3	g	5.00%		
4				
5	RRR	Current Stock Price		
6	5.50%	=$B$2/(A6-$B$3)		
7	6.00%			

Fig 3.6.6: Current Stock Price

Chart preparation Steps:

1. Select Range A5:B25.
2. Goto Insert Tab > Charts Section > Scatter Chart > Select the chart as show below.

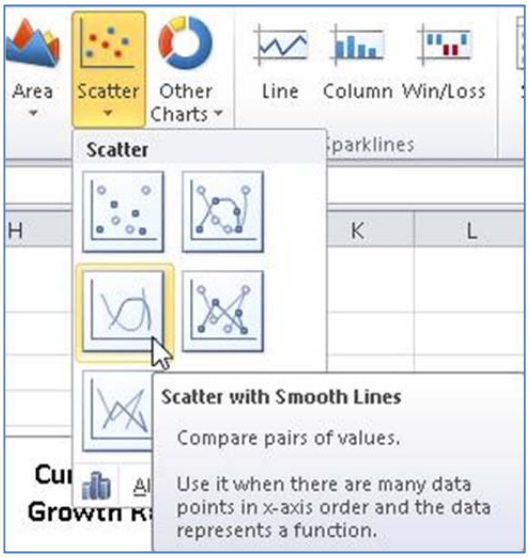


Fig 3.6.7: Scatter Chart

3. Select the numbers on X axis and double click on them. This will open a Format Axis window.

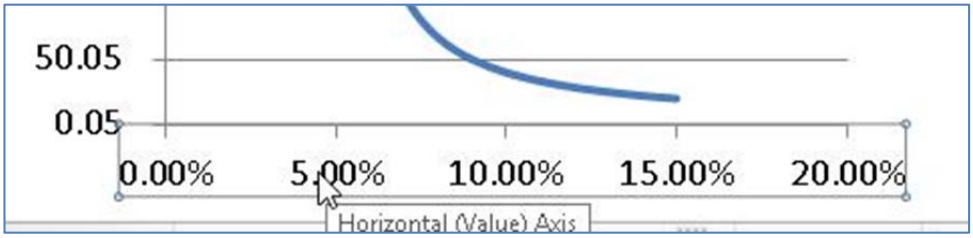


Fig 3.6.8: Select Numbers on X-axis

4. On the Format Axis window, change the following setting to 0.05 (5%) since our required rate starts at 5.5% we don't want value 0 on X axis. After making this change close the window

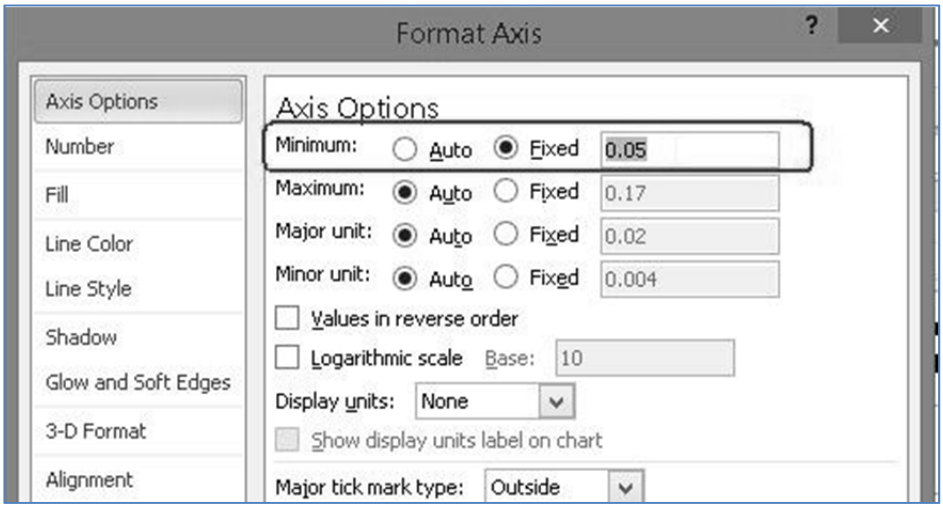


Fig 3.6.9: Format Axis

5. Change the title of the chart to your preference.
6. Depending on the formatting options used you shall get a chart similar to the following image.

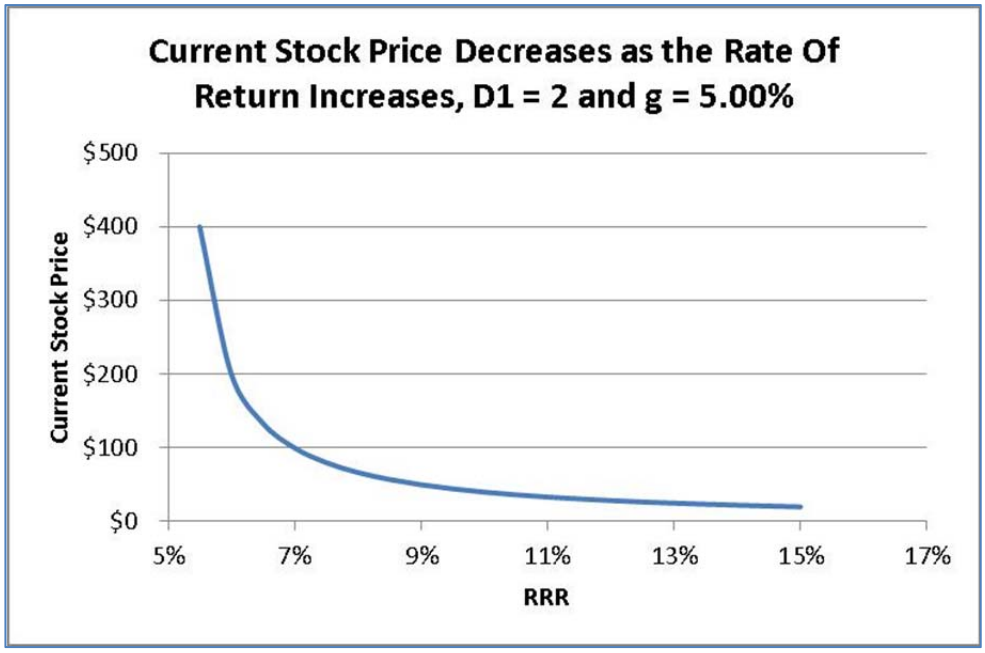


Fig 3.6.10: Stock price sensitivity to expected return rate

This chart clearly depicts how the price falls with every increase in the Expected rate of return.

3.7 Summary

Excel is an invaluable tool for data analysis. In this chapter, we learnt how to apply simple formula and functions that allow us to analyze financial data. We learnt to create and format charts. Charts are one of the most important visual analysis tools available in excel. We learnt how to use Du-pont analysis in excel by proper data structuring and simple functions. We also learnt decision making like whether it was feasible to Lease a machinery or should it be purchased. In addition, we also learnt how to use charts to analyze trends and recognize the possibility of a fraud.

References

[1] Excel 2010 Formulas; John Walkenbach; Wiley Publishing

[2] Financial Shenanigans; Howard Shilit; Mc Graw Hill.

CHAPTER

4 MATHEMATICAL AND STATISTICAL TOOLS FOR FINANCIAL ANALYSIS

LEARNING OBJECTIVES

- To learn statistical features of excel
- To learn Testing of hypothesis
- To learn confidence interval
- To learn level of confidence and level of significance
- To learn ANOVA
- To learn Regression Analysis

4.1 Introduction

This chapter focuses on the statistical features of Excel application. The primary goal of this chapter is not to impart knowledge of statistics as a subject, thus basic knowledge of statistics is presumed.

A “Statistic” can be a numerical fact, like Google has a 5% return last month or a test average in a class was 79 points.

Statistics as a discipline = It is an art and science of collecting, presenting and interpreting data.

It’s an Art because the presentation of your analysis matters a lot.

It’s a science because we must use the scientific methods of experiment and probability.

Data means chunks of some values. It can be any value first name, last name, month names etc. Information is data represented in a useful way.

Interpretation of data means that we make useful information from data, using statistics or any tool, so that we can take decisions. Since future is always uncertain we try to use statistics on the past data in an attempt to predict the future and take decisions important decisions.

4.2 Enable Data Analysis Toolpak

Go to File menu – Options – Add-ins Section as shown in Fig 4.2.1

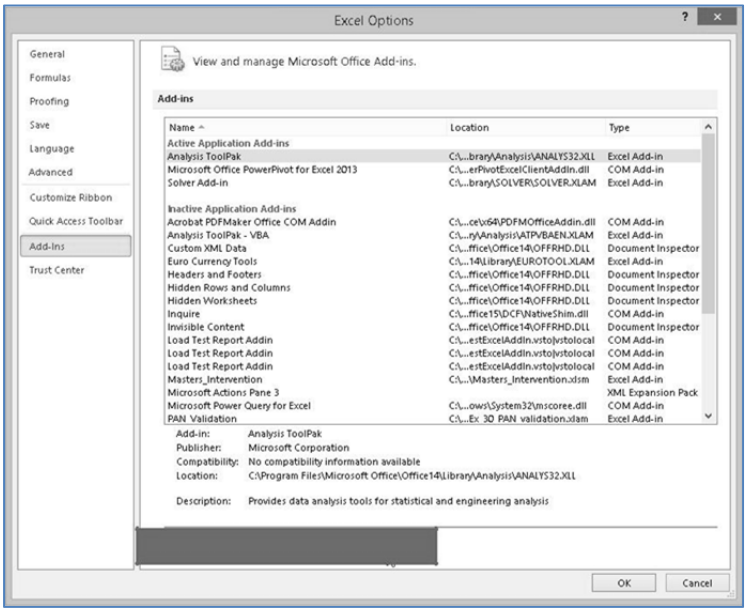


Fig. 4.2.1: Excel Options

Enable Analysis ToolPack and click OK. A button called Data Analysis shall be added to Data tab – Analysis section as shown in Fig 4.2.2

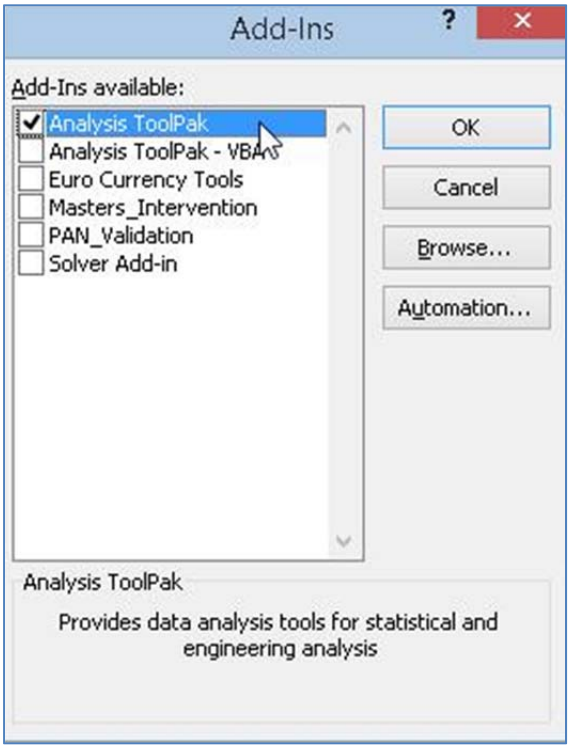


Fig. 4.2.2: Add-Ins

4.3 Basic Statistical Functions

Arithmetic Mean: A typical value that represents all the data points. To get this value we just add up all the numbers and divide by the count.

Let us take an example of marks of 40 students. We shall calculate the mean value of those marks using AVERAGE function as shown in Fig 4.3.1.

	A	B	C	D	E	F	G	H
1	Arithmetic mean: We add up the values and divide by the count							
2								
3	Arithmetic mean		61.38	→ =AVERAGE(A5:H9)				
4							test scores - 40 students	
5	85	59	86	42	64	95	53	76
6	52	49	73	41	50	50	90	75
7	51	42	55	49	41	40	62	84
8	82	82	81	48	68	48	45	51
9	61	78	54	50	62	57	59	65

Fig. 4.3.1: Arithmetic Mean

Median: When a data set has high fluctuations or extremes in its values we cannot take the arithmetic mean as a representative of the entire population. This is because the extreme values in the data set will drag the arithmetic mean too high or too low. Thus in such a scenario we use median which is the middle value in a given data set.

Let us take an example of salaries. We have a data of salaries of 20 individuals, we shall calculate their median as well as mean as shown in Fig 4.3.2

	A	B	C	D	E	F	G	H
1	Median: It is the middle value (for odd count); average of the middle two value							
2	(for even count).							
3								
4	Median gives us a representative value for our data to make decisions. As soon							
5	as we see that the mean is larger than the median, we know that a few large							
6	values are pulling the mean up.							
7								
8								Salary
9			Median	114,076	785,500	133,409	114,151	97,784
10			=MEDIAN(E9:H13)		545,250	121,737	110,127	64,915
11					260,800	115,102	108,332	64,196
12			Mean	166,364	149,354	114,831	91,842	53,072
13			=AVERAGE(E9:H13)		144,330	114,001	88,949	49,594

Fig. 4.3.2: Arithmetic Median

Mode: Mode is the value with the highest recurrence in a given dataset as shown in Fig 4.3.3

Let us again take example of test scores and find Mode using MODE.SNGL function

	A	B	C	D	E	F	G	H
1	Mode: It is one value that occurs most frequently							
2							Test scores	
3					92	89	84	98
4			Mode	89	76	73	89	84
5					99	93	86	94
6			=MODE.SNGL(E3:H7)		89	80	78	93
7					95	86	94	71

Fig. 4.3.3: Mode

4.4 Testing of Hypothesis

Hypothesis is a statement about a population parameter subject to verification. Example:

Suppose a report says that monthly salary of CAs in industry is ₹ 60,000/-

Now we may or may not agree with the above report. We may even try testing the authenticity of the claim by carrying out such an analysis in our region. This test that we conduct would be known as hypothesis testing.

4.4.1 Hypothesis, Tests and Errors

Hypothesis testing is a statistical procedure that uses sample evidence and probability theory to determine whether a statement about the value of a population parameter:

- Should be rejected
- Should NOT be rejected

After the testing we shall make a concluding statement about the population parameter based on sample evidence.

Continuing the above example of CAs in industry, we actually try testing the report in our region and according to our test the average monthly salary turns out to be ₹ 63,500/-. We cannot immediately conclude that the original report was wrong or that our report is correct because our report is based on a sample that is different than the sample tested by the original report. Thus we need to first find out the difference between our result and the original result.

The difference is ₹ 3,500 (₹ 63,500 – ₹ 60,000). This difference is known as Standard Error. We have to decide if this standard error is “statistically significant” or “statistically insignificant”. Thus what we have to follow a scientific procedure to reach a conclusion as to whether the result of our test is significant enough to override the original test.

A hypothesis is a guess about the way the world works. It's a tentative explanation of some process, whether that process is natural or artificial. Before studying and measuring the individuals in a sample, a researcher formulates hypotheses that predict what the data should look like. Generally, one hypothesis predicts that the data won't show anything new or interesting. Dubbed the null hypothesis (abbreviated H0), this hypothesis holds that if the data deviate from the norm in any way, that deviation is due strictly to chance. Another hypothesis, the alternative hypothesis (abbreviated H1), explains things differently. According to the alternative hypothesis, the data shows something important.

After gathering the data, it's up to the researcher to make a decision. The way the logic works, the decision centers around the null hypothesis. The researcher must decide to either reject the null hypothesis or not to reject the null hypothesis. Hypothesis testing is the process of formulating hypotheses, gathering data, and deciding whether to reject or not reject the null hypothesis.

Regardless of the reject-don't-reject decision, an error is possible. One type of error occurs when you believe that the data show something important and you reject H0, and in reality the data are due just to chance. This is called a Type I error.

The other type of error occurs when you don't reject H0 and the data are really due to something out of the ordinary. For one reason or another, you happened to miss it. This is called a Type II error as show in Fig 4.4.1

Decisions and errors in Hypothesis testing		
Decision	True state of the world	
	H_0 is true	H_1 is true
Reject H_0	Type I error	Correct decision
Do not Reject H_0	Correct decision	Type II error

Fig. 4.4.1: Type II error

4.4.2 Case Study

Now that we have a basic understanding of hypothesis testing we shall take up the example of CAs in industry as shown in Fig 4.4.2

A statement from an official report says that CAs in industry earn 60,000 per month.
We feel that CAs in industry have a mean annual salary of more than 60,000 per month. At alpha = .05, sigma = 12,549, n = 36 and sample mean = 63,500, can we conclude that CAs earn more than 60,000?

Fig. 4.4.2: Basic understanding of Hypothesis testing

Before we reach to any conclusions we have to check whether difference of 3,500 is statistically significant. Thus we perform a hypothesis test and decide our Null and Alternate Hypothesis statement. We select a value of α that shall be acceptable to us.

Hypothesis Test (Significance Test)				
Step 1: List H_0 and H_a	H_0 : μ	<=	60,000	
	H_a : μ	>	60,000	
Step 2: Select Alpha	Alpha =	0.05	Alpha = α = Risk of rejecting H_0 when it is actually true = Type 1 Error	

Fig. 4.4.3: Hypothesis testing step-1 and step-2

Now we shall calculate X bar, Standard Error and Z value.

We have the sample salaries in range A4:A39

	C	D	E	F	G	H	I
9	Step 3: Collect Data, Calculate Sample Statistics, Calculate Test Statistic						
10	Hypothesized Mean = μ0 =	60,000					
11	Sigma = σ =	12,549					
12	Test Statistic To Use:	z					
13	sample size = n	36					
14	Sample Mean = Xbar	63,500	→	=AVERAGE(values)	→	=AVERAGE(A4:A39)	
15	Alpha = α =	0.05					
16	SE	2091.5	→	=Sigma/SQRT(n)	→	=D11/SQRT(D13)	
17	Test Statistic = z =	1.673440115	→	=(Xbar - μ_0)/SE	→	=(D14-D10)/D16	

Fig. 4.4.4: Hypothesis testing Step-3

We shall calculate the p-value and the critical value of the one talied test. This will help us to decide whether we have to reject or NOT reject to Null hypothesis.

	C	D	E	F	G	H	I	J
19	Step 4: Create p-value Rejection Rule and calculate p-value							
20	Rejection Rule:	p-value <= alpha, Reject H_0 and accept H_a, otherwise Fail to Reject H_0						
21	p-value One Tail To Right	0.047120343	→	=1-NORM.S.DIST(z,1)	→	=1-NORM.S.DIST(D17,1)		
22								
23	Step 4: Calculate Critical Value and Critical Value Rejection Rule							
24	Rejection Rule:	Test Statistic >= Critical Value, Reject H_0 and accept H_a, otherwise Fail to Reject H_0						
25	Critical Value One Tail To Right	1.644853627	→	=NORM.S.INV(1-alpha)	→	=NORM.S.INV(1-D15)		
26								

Fig. 4.4.5: Hypothesis testing Step-4

Finally, we come to the conclusion that

Step 5: Write Conclusion
Since, the p-value of 0.047 <= alpha of 0.05, we reject H0 and accept Ha.
Since, the test statistic of 1.67 >= critical value of 1.644, we reject H0 and accept Ha.

Fig. 4.4.6: Hypothesis testing Step-5

4.5 Confidence Interval

The Confidence Interval of a Mean is an interval in which the true population mean probably lies based upon a much smaller random sample taken from that population. A 95% Confidence Interval of a Mean is the interval that has a 95% chance of containing the true population mean.

The width of a Confidence Interval is affected by the sample size. The larger the sample size, the more accurate and tighter is the estimate of the true population mean. The larger the sample size, the smaller will be the Confidence Interval. Samples taken must be random and also be representative of the population.

4.5.1 Level of Confidence and Significance

Level of Significance: α ("alpha"), equals the maximum allowed percent of error. If the maximum allowed error is 5%, then α = 0.05.

Level of Confidence: It is the desired degree of certainty. A 95% Confidence Level is the most common. A 95% Confidence Level would correspond to a 95% Confidence Interval of the Mean. This would state that the actual population mean has a 95% probability of lying within the calculated interval. A 95% Confidence Level corresponds to a 5% Level of Significance, α = 0.05. The Confidence Level therefore equals 1 – α

Standard Error: It is an estimate of population Standard Deviation from data taken from a sample. If the population Standard Deviation (σ), is known, then the Sample Standard Error, Sxavg, can be calculated. If only the Sample Standard Deviation (s) , is known, then Sample Standard Error, Sxavg, can be estimated by substituting Sample Standard Deviation (s), for Population Standard Deviation (σ) , as follows:

Sample Standard Error = **Sxavg** = **σ** / SQRT(**n**) = **s** / SQRT(**n**)

σ = Population Standard deviation **s** = Sample standard deviation

n = sample size

4.5.2 Region of Certainty vs Region of Uncertainty

Region of Certainty is the area under the Normal curve that corresponds to the required Level of Confidence. If a 95% percent Level of Confidence is required, then the Region of Certainty will contain 95% of the area under the Normal curve. The outer boundaries of the Region of Certainty will be the outer boundaries of the Confidence Interval.

Region of Uncertainty is the area under the Normal curve that is outside of the Region of Certainty. Half of the Region of Uncertainty will exist in the right outer tail of the Normal curve and the other half in the left outer tail.

4.5.3 Case Study

Calculate a Confidence Interval from a Random Sample of Test Scores

Given the following set of 32 random test scores taken from a much larger population, calculate with 95% certainty an interval in which the population mean test score must fall. In other words, calculate the 95% Confidence Interval for the population test score mean. The random sample of 32 tests scores is shown next.

	A	B	C	D
1				
2	Test scores			
3	220	370	500	640
4	300	410	540	660
5	370	500	640	220
6	410	540	660	300
7	500	640	220	370
8	540	660	300	410
9	220	300	370	410
10	500	540	640	660

Fig. 4.5.1: Random sample

We shall use the following functions to get confidence interval boundaries:

COUNT, AVERAGE, STDEV.S, SQRT, NORM.S.INV, CONFIDENCE

	F	G	H
1			
2	Calculations	Formula	Ans
3	**Level of Significance** = α		5%
4	**Level of Confidence** = 1 - α	=1-H3	95%
5	**Sample Size** = n	=COUNT(A3:D10)	32
6	**Sample Mean** = X_{avg}	=AVERAGE(A3:D10)	455
7	**Sample Standard Deviation** = s	=STDEV.S(A3:D10)	149.8
8	**Sample Standard Error** = S_{xavg} = σ / SQRT(n) ≈ s / SQRT(n)	=H7/SQRT(H5)	26.5
9	**Z Score**$_{(1-\alpha)}$ = Z Score$_{95\%}$ = NORMSINV (1 - α/2)	=NORM.S.INV(1-H3/2)	1.96
10	**Width of Half the Confidence Interval** = CONFIDENCE (α, s, n)	=CONFIDENCE(H3,H7,H5)	51.9
11	Also, equivalently:		
12	**Width of Half the Confidence Interval** = Z Score$_{(1-\alpha)}$ * S_{xavg}	=H9*H8	51.9
13	**Confidence Interval Boundaries** = X_{avg} +/- Z Score$_{(1-\alpha)}$ * S_{xavg}		
14	**Limit low**	=H6-H10	403.1
15	**Limit upper**	=H6+H10	506.9

Fig. 4.5.2: Calculation

4.6 Analysis of Variance (ANOVA)

4.6.1 Introduction

ANOVA, Analysis of Variance, is a test to determine if three or more different methods or treatments have the same effect on a population. For example, ANOVA testing might be used to determine if three different teaching

methods produce the same test scores with a group of students. The measured output must be some type of group average such as average test score per group or average sales per group. ANOVA testing might also be used to determine if different combinations of product pricing and promotion have different effects in different markets.

4.6.2 ANOVA Tests the Null Hypothesis

The basic test of ANOVA is the Null Hypothesis that the different methods had no effect on the outcome that is being measured. Using the teaching method example, the Null Hypothesis in this case would be that the different teaching methods had no effect on the average test scores of student groups to which different treatments (teaching methods) were applied.

4.6.3 Single Factor ANOVA

Single Factor ANOVA tests the effect of just one factor, in this case, the teaching method, on the measured outputs. The measured outputs are the mean test scores for the groups that had the different teaching methods applied to them. The Null Hypothesis for this one factor states that varying that factor has no effect on the outcome.

We have units of products sold by three different groups of salesman throughout ten days. The observations of the groups are as follows as shown Fig 4.6.1

	A	B	C	D	E
1			One way ANOVA		
2			Groups		
3			Grp 1	Grp 2	Grp 3
4		1	23	56	34
5		2	34	45	76
6		3	65	34	43
7		4	76	65	23
8		5	85	34	37
9		6	34	76	37
10		7	23	24	73
11		8	56	65	85
12		9	76	34	96
13		10	45	23	46
15		Sum	517	456	550
16		Mean	51.7	45.6	55
17		Var	533.79	351.82	631.56

Fig. 4.6.1: One way ANOVA

- Go to Data tab and click on Data Analysis as shown in Fig 4.6.2

Fig. 4.6.2: Data Analysis

- From the window that appears next click on Anova: Single factor

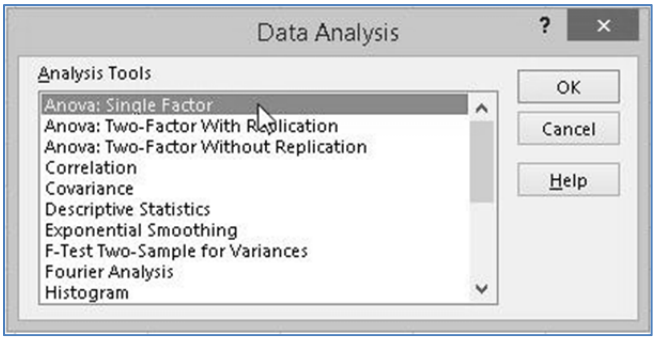


Fig. 4.6.3: Anova single factor

- Select Input Range: =$C$3:$E$13
- Grouped By: “Columns”
- Enable “Labels in first row”
- Set Alpha at 0.05
- Select Output Range: =$G$1; Click OK.

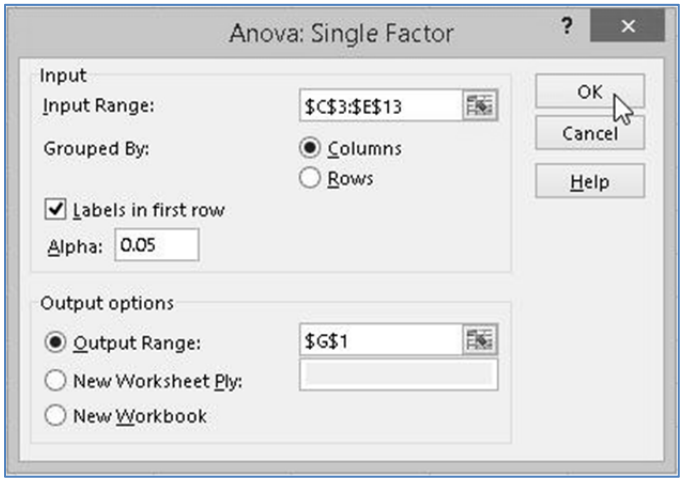
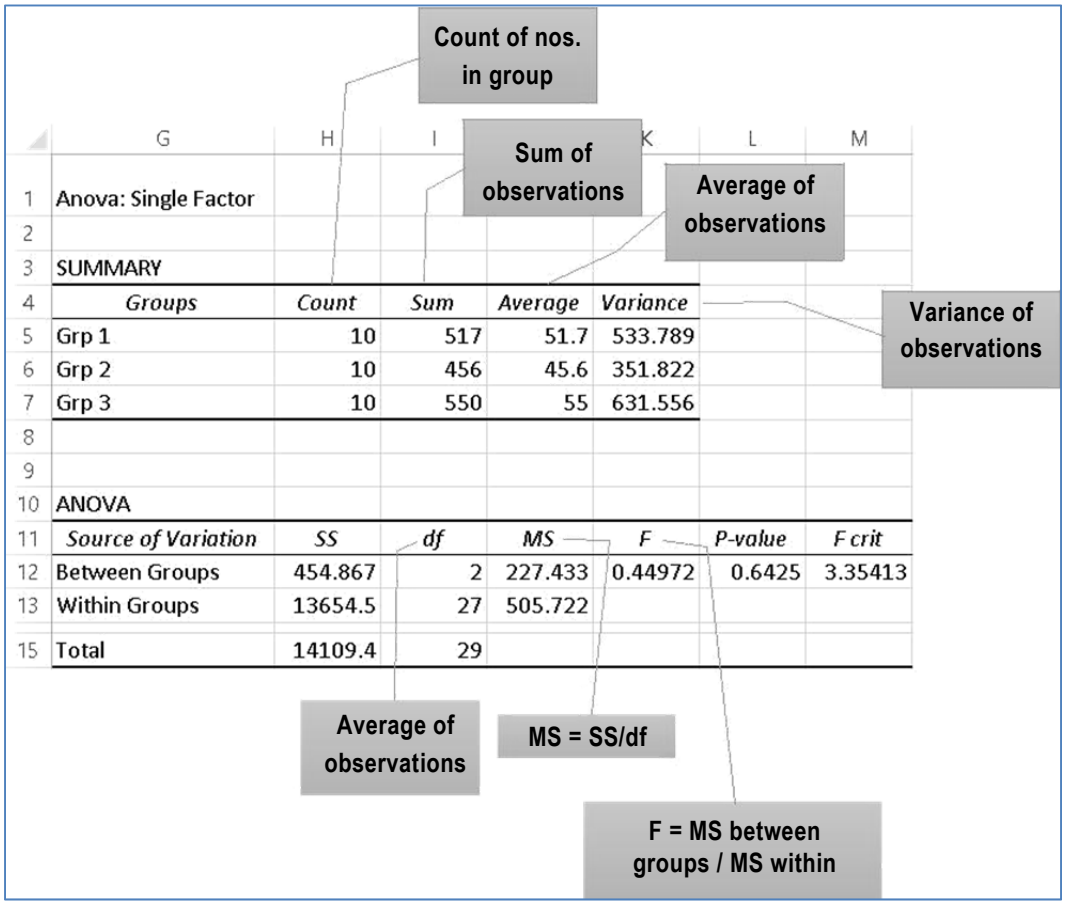


Fig. 4.6.4: Anova: Single Factor



	G	H	I	J	K	L	M
1	Anova: Single Factor						
2							
3	SUMMARY						
4	*Groups*	*Count*	*Sum*	*Average*	*Variance*		
5	Grp 1	10	517	51.7	533.789		
6	Grp 2	10	456	45.6	351.822		
7	Grp 3	10	550	55	631.556		
8							
9							
10	ANOVA						
11	*Source of Variation*	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
12	Between Groups	454.867	2	227.433	0.44972	0.6425	3.35413
13	Within Groups	13654.5	27	505.722			
15	Total	14109.4	29				

Fig. 4.6.5: Output

H0 = μa = μb = μc

Ha = At least one inequality.

Since p – value is greater than α we do not reject H0

Also, f value is far less than the f critical hence we are far away from the Rejection Region on f distribution diagram.

4.7 Prediction using Regression

Multiple Regression is a statistical tool used to create predictive models. The Regression Equation - the end result of the Regression – predicts the value of an output variable (the dependent variable) based upon the values of one or more input variables (the independent variables). If there are more than one independent variable, the Regression is classified as Multiple Regression. To begin the Regression procedure, you need completed sets of independent variables and their resulting outputs, the dependent variables.

To begin the Regression procedure, you need completed sets of independent variables and their resulting

outputs, the dependent variables. Below is an example of the data needed to calculate a Regression equation as shown in Fig 4.7.1.

Dependent Variable *(Output)*	Independent Variables *(Inputs)*			
y	x_1	x_2	x_3	x_4
10	2	4	5	7
12	4	3	7	8
14	6	5	8	0
16	5	6	6	10
13	6	4	8	28

Fig. 4.7.1: Calculate Regression equation

4.7.1 Regression Equation

Regression Analysis will be run on the above data. The output of the Regression Analysis below is called the Regression Equation:

y = B0 + (B1 * x1) + (B2 * x2) + (B3 * x3) + (B4 * x4)

B0, B1, B2, B3 and **B4** are Coefficients of the Regression Equation. This Regression Equation allows you to predict a new output (the dependent variable y) based upon a new set of inputs (the independent variables **x1, x2, x3,** and **x4)**.

4.7.2 Case Study

Below are the monthly rates of return of 4 stocks: (Google, Yahoo, MS, and Apple) and the Tech Index. Create a Regression Equation that will predict the Tech Index return for a given month if a different set of rates of return for each company's stock are input as shown in Fig 4.7.2.

	A	B	C	D	E	F
12	Monthly Rates of Return					
13	Date	Tech Index	Google	Yahoo	MS	Apple
14	01-Apr-13	0.8799	0.7541	2.1407	-4.63	-18.841
15	01-May-13	7.5187	14.97	-2.595	18.986	6.6964
16	01-Jun-13	5.558	11.979	7.7869	-1.723	-3.3473
17	01-Jul-13	1.3716	7.907	-8.555	-0.554	5.8442
18	01-Aug-13	-1.6289	-5.1724	1.2474	6.679	1.9427
19	01-Sep-13	2.4171	3.4091	0.8214	1.8261	2.1063

Fig. 4.7.2: Case study

The next step in the Regression process is to run a correlation analysis on all variables simultaneously. We only want to input variables in the regression equation that are good predictors of the independent variable. We

will examine the correlation between the dependent variable (the output that we are trying to predict) and each of the possible inputs (the independent variables). Correlation between two variables can take a value from anywhere between -1 and +1. The closer the correlation is to 0, the less correlated the two variables are and the less explaining power the independent variable has for the dependent variable. We want to remove any possible inputs from the regression equation if they have a low correlation with the output.

- Go to Data tab and click on Data Analysis

Fig. 4.7.3: Go to Data Tab

- From the window that appears next click on Correlation as shown in Fig 4.7.4

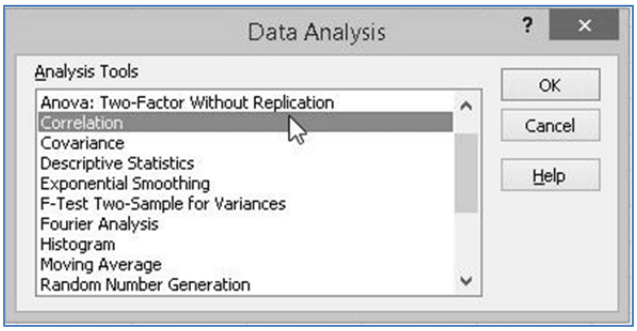


Fig. 4.7.4: Data Analysis

- Select Input Range: =$B$13:$F$19
- Grouped By: “Columns”
- Enable “Labels in first row”
- Select Output Range: =$A$22; Click OK.

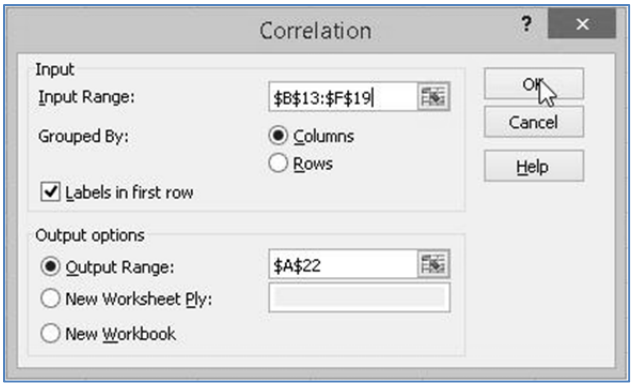


Fig. 4.7.5: Correlation

We shall get the following output. As marked in the output, Apple and Yahoo have low correlations with the Tech Index and therefore are not good predictors of the Tech Index. They should be removed.

Also, if two of the independent variables above are highly correlated with each other, only one of them should be used in the Multiple Regression below. This is not the case here because none of the variables above have a high correlation with another variable.

Using highly correlated variables as inputs to a Multiple Regression causes an error called Multicollinearity and should be avoided as shown in Fig 4.7.6

	A	B	C	D	E	F
22		*Tech Index*	*Google*	*Yahoo*	*MS*	*Apple*
23	Tech Index	1				
24	Google	0.938662	1			
	[redacted]	58	-0.0989	1		
26	MS	0.470349	0.3504	-0.264	1	
	[redacted]	53	0.3423	-0.501	0.6275	1

Fig. 4.7.6: Multiple Regression

- After removing the two columns of Yahoo and Apple. We have the new data as follows.

	A	B	C	D
31	**Date**	**Tech Index**	**Google**	**MS**
32	01-Apr-13	0.8799	0.7541	-4.6296
33	01-May-13	7.5187	14.9701	18.986
34	01-Jun-13	5.558	11.9792	-1.7226
35	01-Jul-13	1.3716	7.907	-0.5535
36	01-Aug-13	-1.6289	-5.1724	6.679
37	01-Sep-13	2.4171	3.4091	1.8261

Fig. 4.7.7: New data

- Now we shall execute regression analysis. In the data analysis window select regression as shown in Fig 4.7.8

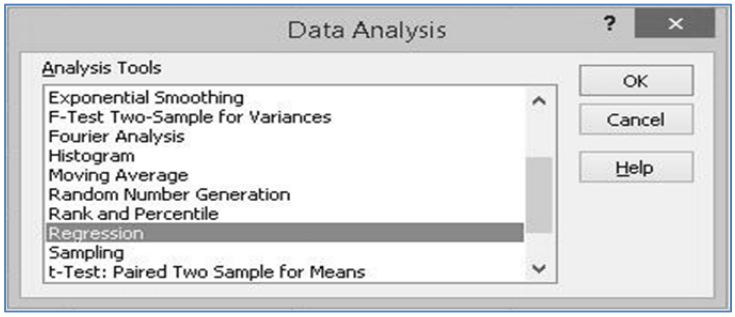


Fig. 4.7.8 Select Regression

- On the window that appears next configure the following
- Input Y Range: $B$31:$B$37
- Input X Range: $C$31:$D$37
- Enable Labels.
- Set Confidence Level at 95%
- Set output range as $A$40
- Enable Residuals
- Click Ok

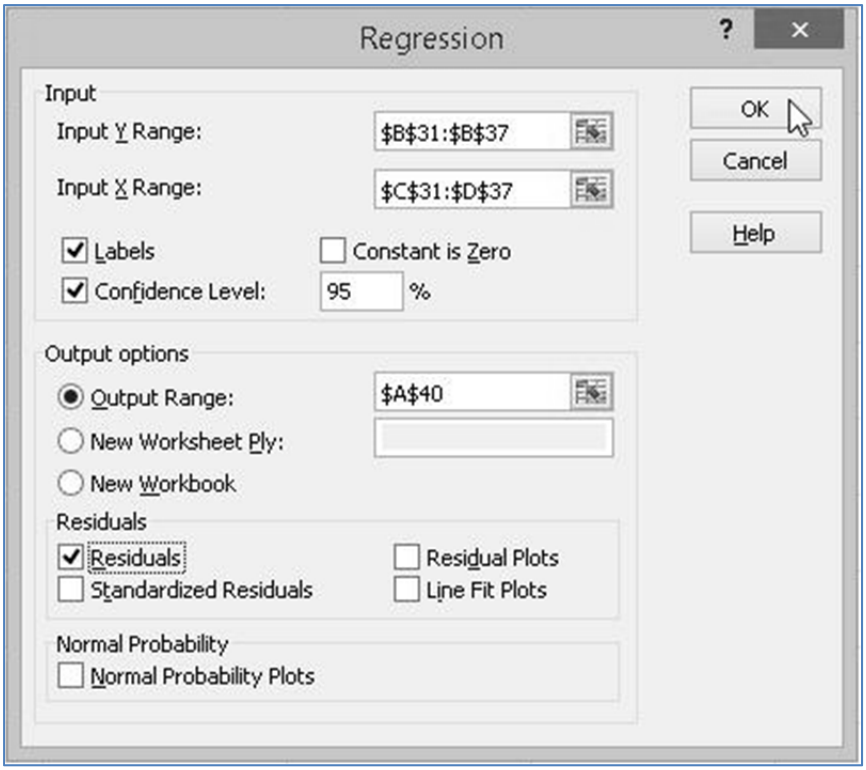


Fig. 4.7.9: Output Regression

As a part of our regression analysis we get the following output.

- Regression statistics and ANOVA

	A	B	C	D	E	F
40	SUMMARY OUTPUT					
41						
42	*Regression Statistics*					
43	Multiple R	0.950726494				
44	R Square	0.903880867				
45	Adjusted R Square	0.839801446				
46	Standard Error	1.330891938				
47	Observations	6				
48						
49	ANOVA					
50		*df*	*SS*	*MS*	*F*	*Significance F*
51	Regression	2	49.969867	24.985	14.10563395	0.029799897
52	Residual	3	5.31382005	1.7713		
53	Total	5	55.28368705			

Fig. 4.7.10: Regression and ANOVA

- Standard Errors and P-values

	A	B	C	D	E
55		*Coefficients*	*Standard Error*	*t Stat*	*P-value*
56	Intercept	0.251395602	0.711022732	0.3536	0.747049498
57	Google	0.39330088	0.085205836	4.6159	0.019133411
58	MS	0.062953947	0.074635551	0.8435	0.460900097

Fig. 4.7.11(A): Standard Errors and P-values

E	F	G	H	I
P-value	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
0.747049498	-2.011396064	2.514187268	-2.011396064	2.514187268
0.019133411	0.122137881	0.664463878	0.122137881	0.664463878
0.460900097	-0.174569686	0.30047758	-0.174569686	0.30047758

Fig. 4.7.11(B): Output

- Residual Output

	A	B	C
62	RESIDUAL OUTPUT		
63			
64	*Observation*	*Predicted Tech Index*	*Residuals*
65	1	0.256532203	0.623367797
66	2	7.334392739	0.184307261
67	3	4.854381033	0.703618967
68	4	3.32638065	-1.95478065
69	5	-1.362444458	-0.266455542
70	6	1.707157834	0.709942166

Fig. 4.7.12: Residual Output

Let's take a look at the meaning of the output derived.

- First and foremost we check the overall accuracy of the regression which is determined by R-square and adjusted R-square.

R-square is 90% which means that 90% of the variance of the output variable can be explained by the variance of input variable. Adjusted R-square is more conservative and more accurate.

- Secondly, we check the probability that the regression output was not obtained by chance (co-incidence)

This can be determined by significance of F for the regression which in our case is 2.8%. Thus there is 2.8% chance that our regression output is mere co-incidence.

- Third, we check the reliability of coefficients and y intercepts. This will be determined by the p-values. Smaller p-values means these values are not a result of co-incidence/chance.
- Lastly, residuals are difference between actual tech index and predictive value of dependent variable. Thus the equation we get is: Tech Index = 0.251 + 0.393 * Google + 0.063 * MS

4.7.3 Using Regression equation to predict an output

Predict the Tech Index if Google = 7 and MS = 4.

Tech Index = (0.251) + (0.393)*(Google) + (0.063)*(MS)

Tech Index predicted = (0.251) + (0.393)*(7) + (0.063)*(4) = 3.25

4.7.4 The Confidence Interval of the Output Variable

The Confidence Interval was set at 95%. This is the default setting.

It could have been set to any desired confidence level.

The 95% Confidence Interval is interval in which the output variable, Tech Index, should fall with 95% certainty.

The 95% Confidence Interval = Tech Index predicted +/- Z Score95% * (Standard Error)

Z score Calculation

Level of Confidence = 95% = 1 – α; Level of Significance = α = 0.05

Z Score 95% = Z Scoreα=0.05 = NORMSINV (0.975) = 1.96

The cell containing the Overall Standard Error for the Regression Equation = 1.33

The 95% Confidence Interval = 3.25 +/- (1.96) * (1.33) = 0.64 to 5.86

This means that there is a 95% chance the actual Tech Index return will fall within 0.64 and 5.86 for inputs Google = 7 and MS = 4.

4.8 Summary

In this chapter we have glanced through some of the statistical features of excel. We have learn how to calculate and interpret ANOVA. We have learnt how to identify our Null and Alternate hypothesis.

We have also learnt how to calculate basic statistical values like mean, median and mode. We have seen how to get a regression equation using regression analysis tools. Based on the derived equation we have learnt to predict an output. We have also learnt how to calculate the confidence interval of the output variable. Thus in this chapter we have touched upon various aspects of statistics as a subject and a few of its use cases in Excel.

References

[1] Statistical Analysis Microsoft Excel 2010 – Conard Carlberg

[2] Excel Data Analysis Modeling and Simulation – Hector Guerrero

CHAPTER

5

APPLICATION OF MS - EXCEL

LEARNING OBJECTIVES

- To know about the various tools available in excel regarding costing and finance.
- To know how to use these tools in practical situations.

5.1 Introduction

Excel is a powerful tool available in the hands of users. Application of excel functions are unlimited. It depends on the imagination of the user only, how a function can be used in a particular situation. In this section we are going to discuss about some of the functions relating to accounting and finance.

When excel was not there, still people used to analyze financial data using traditional tools with lot of limitation. After the availability of excel in the hands of the user, analysis of huge amount of data is possible at an absolutely great speed.

In this section, we are going to discuss financial functions relating to depreciation calculation, marginal costing, cash budgeting, discounting, tax calculations, EMI calculations, capital budgeting, risk analysis and investment, financial planning, etc.

In today's era of technology, it is directly / indirectly compulsory for an accounting professional to learn these financial functions in excel to ensure his/her existence in this competitive world. Knowledge of these technological tools gives us an added advantage of handling huge amount of data at a great speed.

So, let us start understanding one by one some of the useful functions in excel relating to accounting and finance.

5.2 Depreciation Accounting

Depreciation stands for reduction in value of fixed assets. Value of fixed assets is generally reduced over the period of time due to any of the following reasons.

(a) Wear & Tear

(b) Change in taste of people

(c) Change in technology.

Depreciation is considered as non cash expenditure and occupies a prominent place in Profit & Loss Account. If value of fixed asset is high, then depreciation may also be quite substantial figure.

In excel, there are five different functions for calculation of depreciation. These are as under.

Sr. No.	Function	Use
1	SLN	For calculation of depreciation as per Straight Line Method.
2	SYD	For calculation of depreciation as per Sum of Years' Digit Method
3	DB	For calculation of depreciation as per Declining BalanceMethod.
4	DDB	For calculation of depreciation as per Double Declining Balance Method
5	VDB	For calculation of depreciation as per Variable Declining Balance Method

Table 5.2.1: Five different functions for calculation of depreciation

1. SLN Function:

SLN function is used for calculation of depreciation figure as per Straight Line Method. In this method, the amount of depreciation remains constant over the period of time and it does not change every year. Following three inputs are required for calculation.

(a) Cost – Cost incurred for acquiring fixed asset.

(b) Salvage Value – The value which can be realized at the end of life of fixed asset by selling it.

(c) Life – Total life of fixed assets in years as shown in Fig 5.2.1.

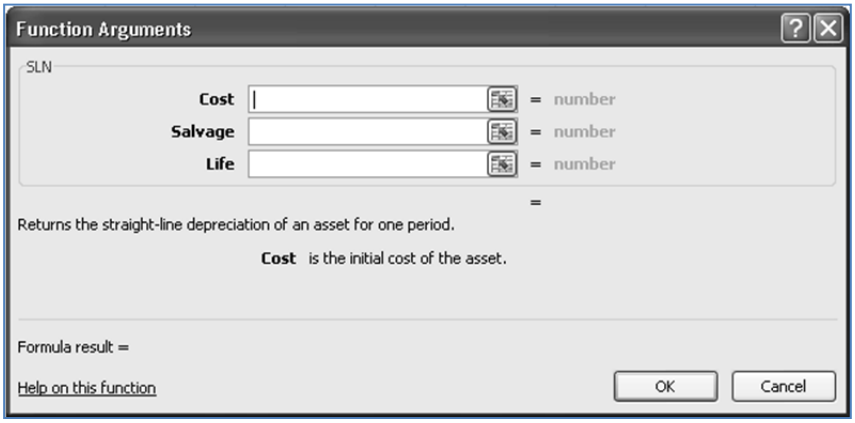


Fig.5.2.1: SLN function

2. SYD Function:

SYD stands for Sum of Years' Digits. Sum of the years' digits method of depreciation is one of the accelerated depreciation techniques which are based on the assumption that assets are generally more productive when they are new and their productivity decreases as they become old as shown in Fig 5.2.2.

Formula for calculation of depreciation under SYD is as under

$$\text{Depreciation} = \text{Depreciable Base} \times \frac{\text{Remaining Useful Life}}{\text{Sum of Years' Digits}}$$

Depreciable Base = Cost less Salvage Value

Remaining Useful Life = Useful life remaining in the beginning of each year for which depreciation is to be calculated.

Sum of Years' Digits = Total of digits of years.

E.g. if total life of asset is 10 years, the sum of years digit shall be 10+9+8+7+6+5+4+3+2+1 = 55.

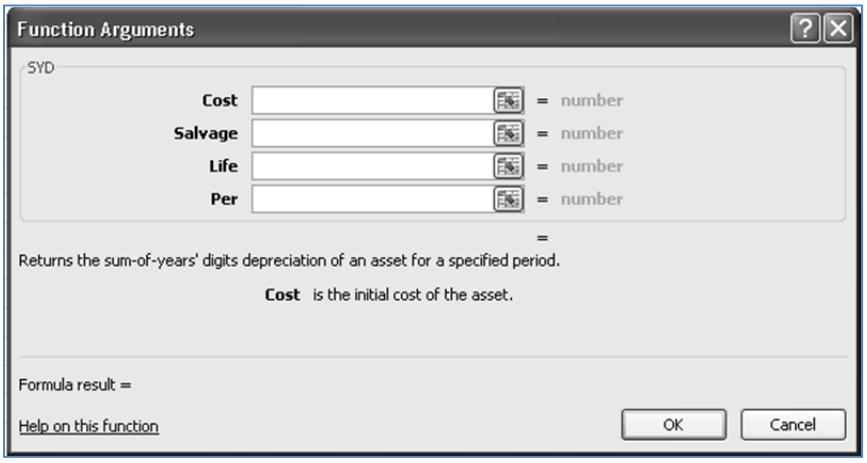


Fig.5.2.2: SYD function

3. DB Function:

DB stands for declining balance. This method uses a fixed rate to calculate depreciation. Rate is calculated using the formula as under.

Rate = 1 – ((Salvage Value / Cost) ^ (1 / Life))

Depreciation = (Cost – Previous Depreciation) x rate

Amount of depreciation will keep on decreasing every year. The total amount of depreciation amount for all the years shall be equal to the cost less salvage value as shown in Fig 5.2.3.

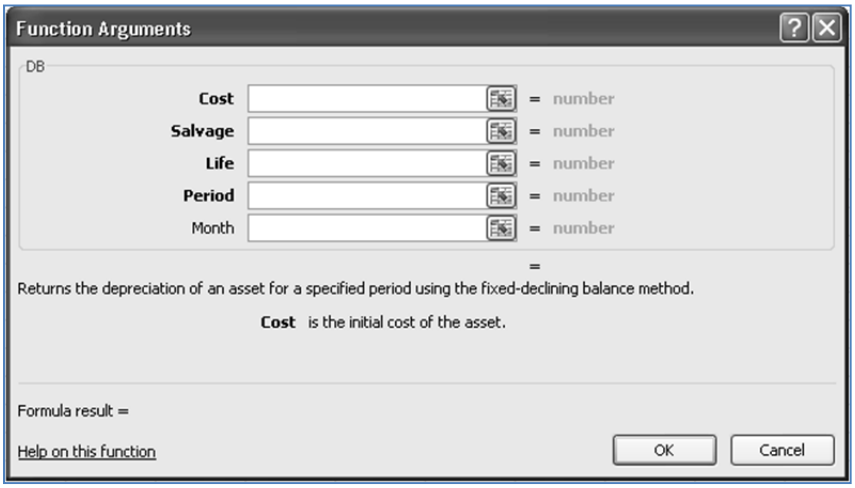


Fig.5.2.3: DB function

4. DDB Function:

When calculating the depreciation of an asset, it is common to use an accelerated depreciation calculation, in which the calculated value of an asset is reduced by a larger amount during the first period of its lifetime, and smaller amounts during subsequent periods.

One of the most popular accelerated depreciation methods is the Double Declining-Balance Method, in which the straight-line depreciation rate is doubled.

The Excel DDB function uses the following equation to calculate the depreciation

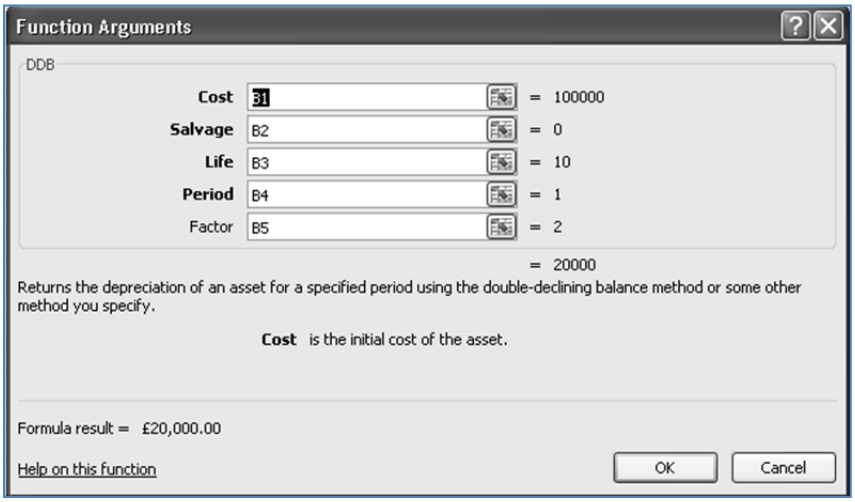


Fig.5.2.4: DDB function

Following variables shall be used in the calculation of depreciation using DDB function.

Cost – Initial cost of the asset

Salvage – Value of asset at the end of the life of asset

Life – The total number of periods over which the asset is being depreciated. It is sometimes called as the useful life of the asset.

Period – The period for which you want to calculate depreciation. Period must use the same units as life. E.g. Depreciation for 2nd Year, 3rd Year, etc.

Factor – The rate at which balance declines. If omitted, it is assumed as 2.

5. VDB Function:

VDB stands for variable declining balance. The VDB function uses the DDB (Double Declining Balance) method by default. The VDB function performs the same calculations as the DDB function. However, it switches to Straight Line calculation to make sure you reach the salvage value. It only switches to Straight Line calculation when Depreciation Value as per Straight Line Method is higher than Depreciation Value as per DDB method.

There are two additional arguments in VDB function.

Start_period – It is starting period for which you want to calculate depreciation.

End_period – It is the ending period for which you want to calculate depreciation.

VDB function is much more versatile than the DDB function. It can calculate the depreciation value of multiple periods as shown in Fig 5.2.5.

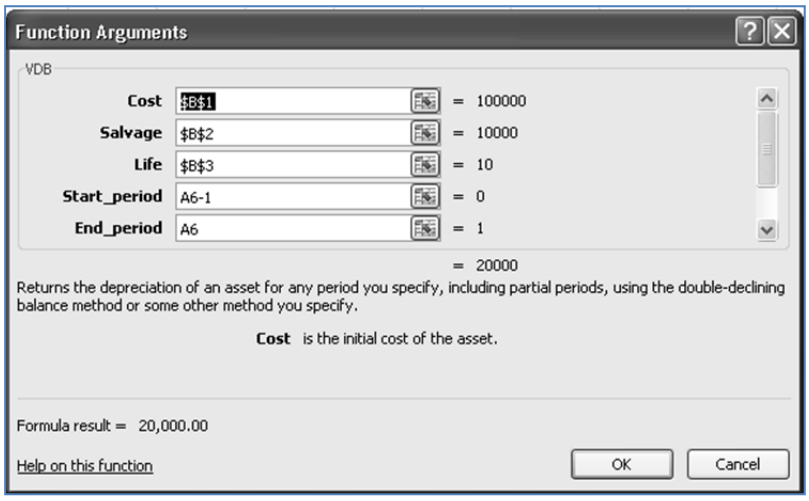


Fig 5.2.5: VDB function

Example : Let us try to find out the depreciation calculation using all the five methods discussed above.

Cost : 1,00,000

Salvage : 10,000

Life : 10

Period	SLN	SYD	DB	DDB	VDB
1	9,000.00	16,363.64	20,600.00	20,000.00	20,000.00
2	9,000.00	14,727.27	16,356.40	16,000.00	16,000.00
3	9,000.00	13,090.91	12,986.98	12,800.00	12,800.00
4	9,000.00	11,454.55	10,311.66	10,240.00	10,240.00
5	9,000.00	9,818.18	8,187.46	8,192.00	8,192.00
6	9,000.00	8,181.82	6,500.84	6,553.60	6,553.60
7	9,000.00	6,545.45	5,161.67	5,242.88	5,242.88
8	9,000.00	4,909.09	4,098.37	4,194.30	4,194.30
9	9,000.00	3,272.73	3,254.10	3,355.44	3,388.61
10	9,000.00	1,636.36	2,583.76	2,684.35	3,388.61
Total	**90,000.00**	**90,000.00**	**90,041.25**	**89,262.58**	**90,000.00**

5.3 Marginal Costing

In economics and finance, marginal cost stands for change in the total cost that arises when the quantity produced has an increment by unit. That is, it is the cost of producing one more unit of a good.It is computed in situations where the breakeven point has been reached: the fixed costs have already been absorbed by the already produced items and only the direct (variable) costs have to be accounted for.

Marginal costs are variable costs consisting of labor and material costs, plus an estimated portion of fixed costs (such as administration overheads and selling expenses). In companies where average costs are fairly constant, marginal cost is usually equal to average cost. However, in industries that require heavy capital investment (automobile plants, airlines, mines) and have high average costs, it is comparatively very low. The concept of marginal cost is critically important in resource allocation because, for optimum results, management must concentrate its resources where the excess of marginal revenue over the marginal cost is highest. It is also called choice cost, differential cost, or incremental cost.

Marginal costing is the system of calculating marginal costs for the purpose of financial and business decisions. Various concepts and tools are used for calculating marginal costs for the purpose of business decision making.

Marginal costing mainly uses terms as under. Understanding of these terms is necessary before we proceed to discuss marginal costing in Excel.

5.3.1 Marginal Costing Equations

Following equations are used in Marginal Costing.

(a) Profit = Sales – Total Cost

(b) Total Cost = Fixed Cost + Variable Cost

(c) Contribution = Sales – Variable Cost

The whole idea of marginal costing revolves around a simple equation as under.

Fixed Cost + Profit = Sales – Variable Cost

(a) **Fixed Costs:** As the name suggest, these cost remain fixed irrespective of level of production. Fixed cost need to be incurred even if there is no production. Examples of fixed cost can be Salary of administrative staff, office rent, audit fees, etc.

Fixed Cost = Sales – Variable Cost – Profit

Fixed Cost = (Sales x PV Ratio) – Profit

(b) **Variable Costs:** As the name suggest, these cost vary according the volume of production. Total variable cost changes after every unit of production. But variable cost per unit remain the same. All direct costs are variable costs. E.g. raw material cost, commission to salesman, etc. are variable cost.

Variable Cost = Sales – Fixed Cost – Profit

Variable Cost = Sales x Variable Cost Ratio

(Variable Cost Ratio = 1 – PV Ratio)

(c) **Sales:** This is the amount generated from selling of products. Total sales can be obtained by multiplying selling price per unit with number of products sold.

(d) **Contribution:** It is the difference between sales and variable cost. As the sales and variable cost can be calculated for each unit, it also possible to calculate contribution per unit using the simple formula as under.

Contribution per unit = Selling Price per Unit - Variable Cost per Unit

Or

$$\text{Contribution per unit} = \frac{\text{Total Sales Value} - \text{Total Variable Cost}}{\text{No. of units sold}}$$

(e) **PV Ratio:** Profit Volume Ratio expresses mathematical relationship between two variables, i.e. Profit and Volume of sales. It can be calculated by using any formula as stated below.

PV Ratio = (Contribution / Sales) x 100

PV Ratio = [(Sales – Variable Cost) / Sales] x 100

PV Ratio = 1 – Variable Cost Ratio

PV Ratio = (Change in Profit / Change in Sales) x 100

(f) **BEP:** Break Even Point is the point of no profit or no loss. It may be expressed in terms of sales value or sales unit. It can be calculated as under.

$$\text{BEP (Value)} = \frac{\text{Fixed Cost}}{\text{PV Ratio}}$$

$$\text{BEP (Units)} = \frac{\text{Fixed Cost}}{\text{Contribution per Unit}}$$

(g) **Margin of Safety:** It is the value of sales above the BEP point. It denotes how much safe we are about not incurring losses. If BEP sales is ₹ 100 and total sales is ₹ 140, then margin of safety is calculated as 40, i.e. 140 -100 using the formula as under.

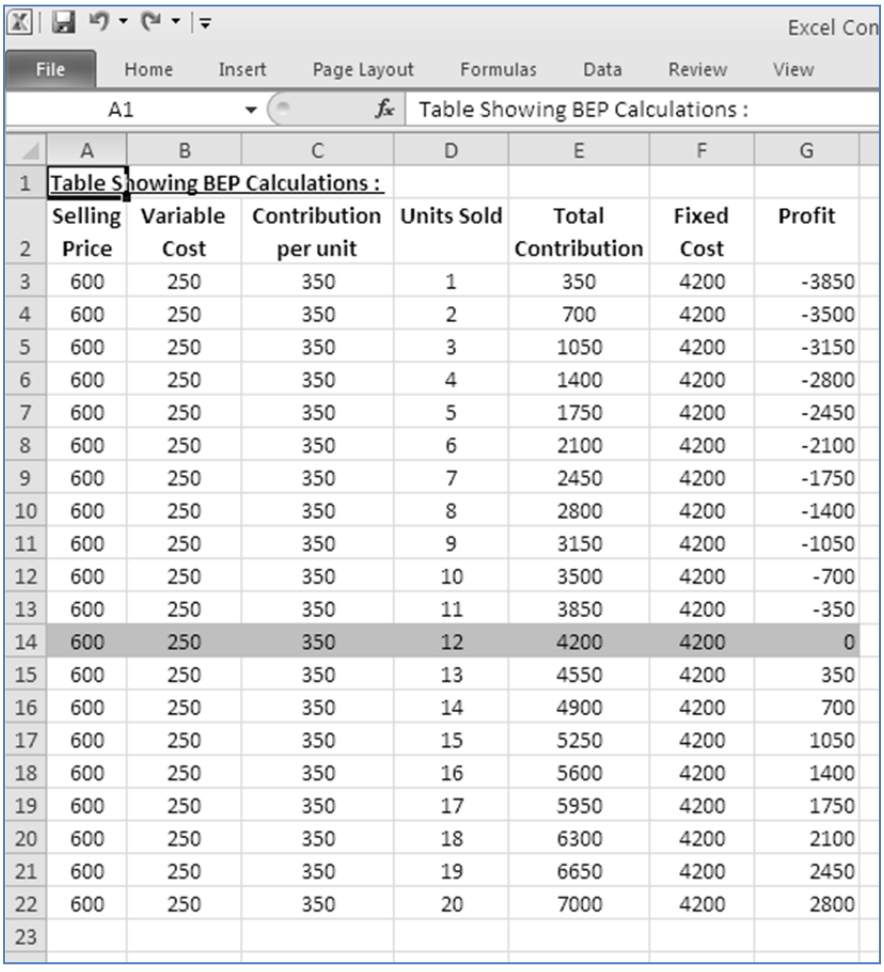
Margin of Safety = Total Sales – BEP Sales

5.3.2 BEP Calculation

Excel can be conveniently used for preparation of chart showing Break Even Point. BEP level can also be calculated without using excel. But it is very easy to change the variables like selling price, variable cost and fixed cost to see the change in BEP level.

Problem 1:

Prepare a chart showing BEP when Selling Price is of a ₹ 600, Variable Cost is ₹ 250 and Fixed Cost is ₹ 4200 as shown in Fig 5.3.1.



	A	B	C	D	E	F	G
1	Table Showing BEP Calculations :						
2	Selling Price	Variable Cost	Contribution per unit	Units Sold	Total Contribution	Fixed Cost	Profit
3	600	250	350	1	350	4200	-3850
4	600	250	350	2	700	4200	-3500
5	600	250	350	3	1050	4200	-3150
6	600	250	350	4	1400	4200	-2800
7	600	250	350	5	1750	4200	-2450
8	600	250	350	6	2100	4200	-2100
9	600	250	350	7	2450	4200	-1750
10	600	250	350	8	2800	4200	-1400
11	600	250	350	9	3150	4200	-1050
12	600	250	350	10	3500	4200	-700
13	600	250	350	11	3850	4200	-350
14	600	250	350	12	4200	4200	0
15	600	250	350	13	4550	4200	350
16	600	250	350	14	4900	4200	700
17	600	250	350	15	5250	4200	1050
18	600	250	350	16	5600	4200	1400
19	600	250	350	17	5950	4200	1750
20	600	250	350	18	6300	4200	2100
21	600	250	350	19	6650	4200	2450
22	600	250	350	20	7000	4200	2800
23							

Fig 5.3.1: BEP Calculation

Pricing Decisions & Discounts:

Excel can also be used for taking decision on product pricing. When large size data is to be handled excel can be really useful in such cases.

Problem 2:

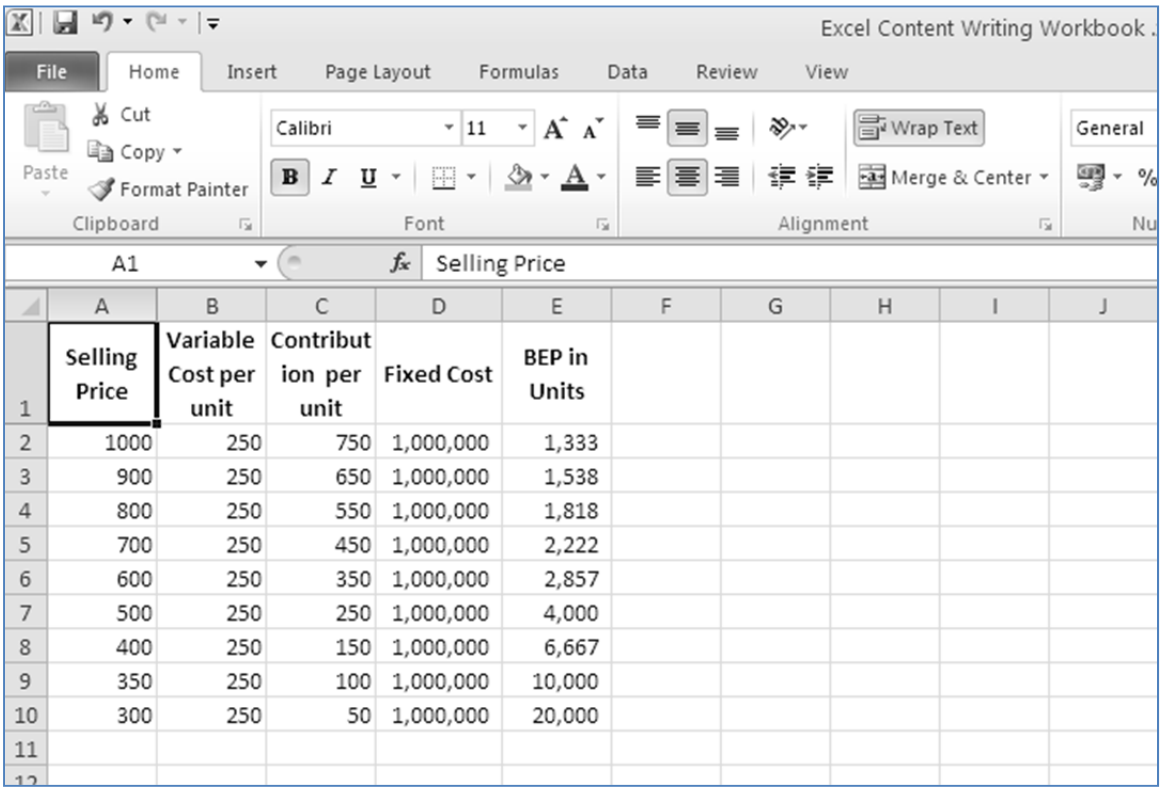
SRT Enterprises is into business of selling cricket bats. They have to take a decision about price of the product. Before the price is decided, marketing department is being consulted about the sales in quantity that can be achieved in the first year. SRT Enterprises wishes to achieve BEP in the first year itself. Consider following data.

Variable Cost = ₹ 250,

Fixed Cost = 10.00 Lacs.

Sales Price Range = ₹ 300 to ₹ 1,000

A chart can be prepared as under to help in decision making as shown in Fig 5.3.2.



	A	B	C	D	E	F	G	H	I	J
1	Selling Price	Variable Cost per unit	Contribution per unit	Fixed Cost	BEP in Units					
2	1000	250	750	1,000,000	1,333					
3	900	250	650	1,000,000	1,538					
4	800	250	550	1,000,000	1,818					
5	700	250	450	1,000,000	2,222					
6	600	250	350	1,000,000	2,857					
7	500	250	250	1,000,000	4,000					
8	400	250	150	1,000,000	6,667					
9	350	250	100	1,000,000	10,000					
10	300	250	50	1,000,000	20,000					
11										

Fig 5.3.2: BEP Calculation

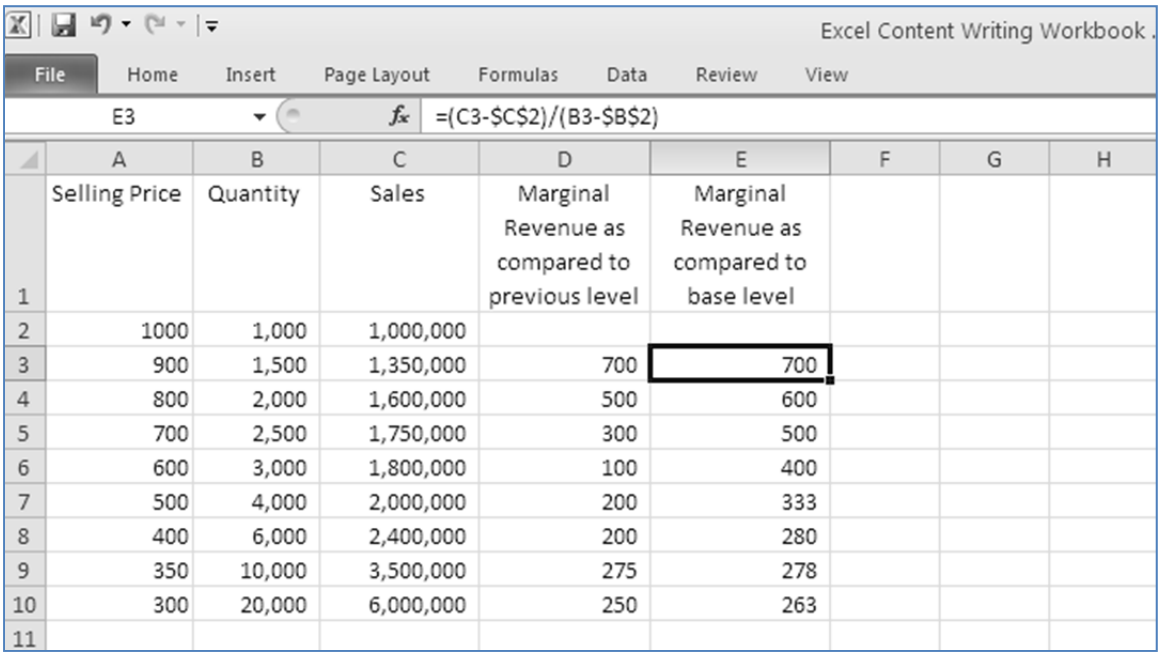
As it is clear from the above table, if selling price is set at ₹ 1,000, BEP shall be achieved by selling 1,333 units while it will take 20,000 units to achieve BEP is product is priced at ₹ 300.

5.3.3 Calculation of Marginal Revenue

If we wish to calculate marginal revenue that would be generated at different sales levels with different selling prices, following formula can be used.

$$\frac{\text{Change in Sales}}{\text{Change in Quantities}}$$

This problem can be solved very easily in excel as given the picture below.



	A	B	C	D	E	F	G	H
1	Selling Price	Quantity	Sales	Marginal Revenue as compared to previous level	Marginal Revenue as compared to base level			
2	1000	1,000	1,000,000					
3	900	1,500	1,350,000	700	700			
4	800	2,000	1,600,000	500	600			
5	700	2,500	1,750,000	300	500			
6	600	3,000	1,800,000	100	400			
7	500	4,000	2,000,000	200	333			
8	400	6,000	2,400,000	200	280			
9	350	10,000	3,500,000	275	278			
10	300	20,000	6,000,000	250	263			
11								

Fig 5.3.3: Calculation of Marginal Revenue

Excel can be used in variety of ways for marginal costing and for taking business decisions using marginal costing. Above examples are just illustrative and not exhaustive.

5.4 Cash Budgeting

Budget stands for planning for future. Cash budget is prepared for planning for future as far as movement of cash is concerned. Movement of cash includes inflow and outflow of cash. Normally bank transactions are also considered in cash budget.

Cash budget is useful in maintaining the smooth flow of cash in business as well as to ensure liquidity during the budget period. Many financial and business decisions are taken on the basis of cash budget, e.g. how much credit to be given to customer, how much funding to be taken from outside sources, etc.

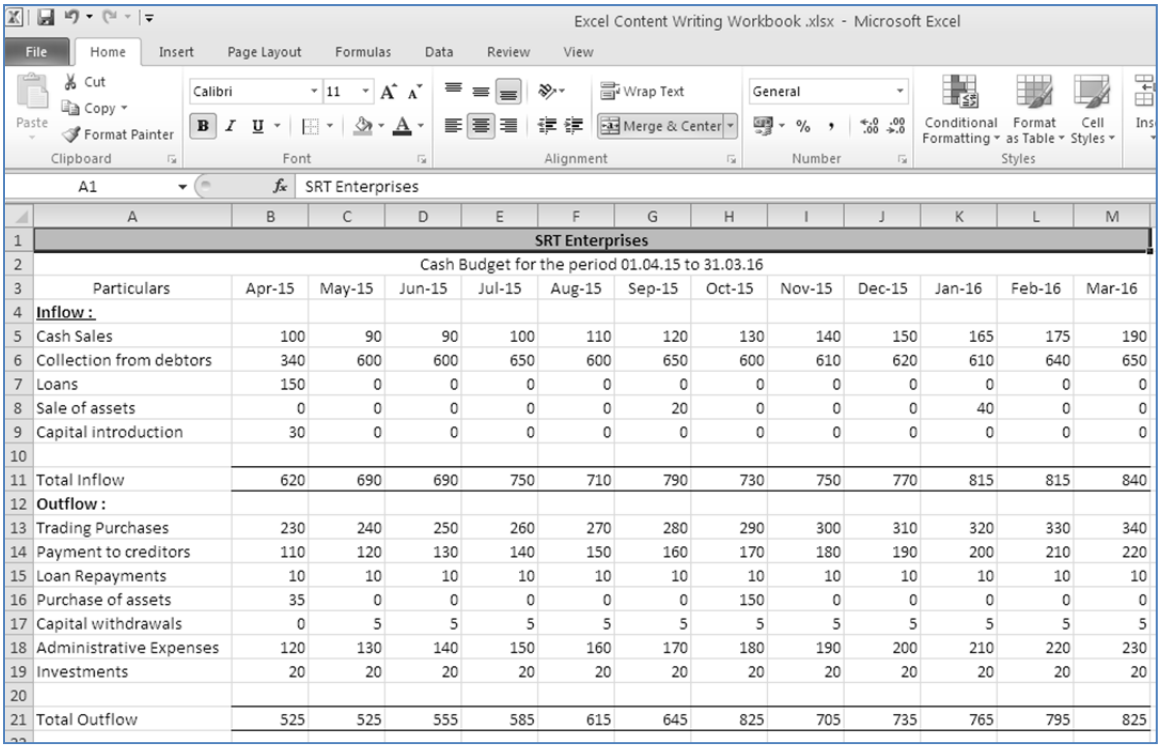
The inputs to the cash budget come from several other budgets. The results of the cash budget are used in the financing budget, which itemizes investments, debt, and both interest income and interest expense. The cash budget is comprised of two main areas, which are Sources of Cash and Uses of Cash. The Sources of Cash

section contains the beginning cash balance, as well as cash receipts from cash sales, accounts receivable collections, and the sale of assets. The Uses of Cash section contains all planned cash expenditures, which comes from the Direct Materials Budget, Direct Labor Budget, Manufacturing Overhead Budget, and Selling and Administrative Expense budget. It may also contain line items for fixed asset purchases and dividends to shareholders.

If there are any unusually large cash balances indicated in the cash budget, these balances are dealt with in the financing budget, where suitable investments are indicated for them. Similarly, if there are any negative balances in the cash budget, the financing budget indicates the timing and amount of any debt or equity needed to offset these balances.

Cash may be prepared for any period ranging from a daily to yearly.

A sample cash budget in excel can be prepared as shown in Fig 5.4.1.



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	SRT Enterprises												
2	Cash Budget for the period 01.04.15 to 31.03.16												
3	Particulars	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16
4	**Inflow :**												
5	Cash Sales	100	90	90	100	110	120	130	140	150	165	175	190
6	Collection from debtors	340	600	600	650	600	650	600	610	620	610	640	650
7	Loans	150	0	0	0	0	0	0	0	0	0	0	0
8	Sale of assets	0	0	0	0	0	20	0	0	0	40	0	0
9	Capital introduction	30	0	0	0	0	0	0	0	0	0	0	0
10													
11	Total Inflow	620	690	690	750	710	790	730	750	770	815	815	840
12	**Outflow :**												
13	Trading Purchases	230	240	250	260	270	280	290	300	310	320	330	340
14	Payment to creditors	110	120	130	140	150	160	170	180	190	200	210	220
15	Loan Repayments	10	10	10	10	10	10	10	10	10	10	10	10
16	Purchase of assets	35	0	0	0	0	0	150	0	0	0	0	0
17	Capital withdrawals	0	5	5	5	5	5	5	5	5	5	5	5
18	Administrative Expenses	120	130	140	150	160	170	180	190	200	210	220	230
19	Investments	20	20	20	20	20	20	20	20	20	20	20	20
20													
21	Total Outflow	525	525	555	585	615	645	825	705	735	765	795	825

Fig 5.4.1: Sample Cash Budget

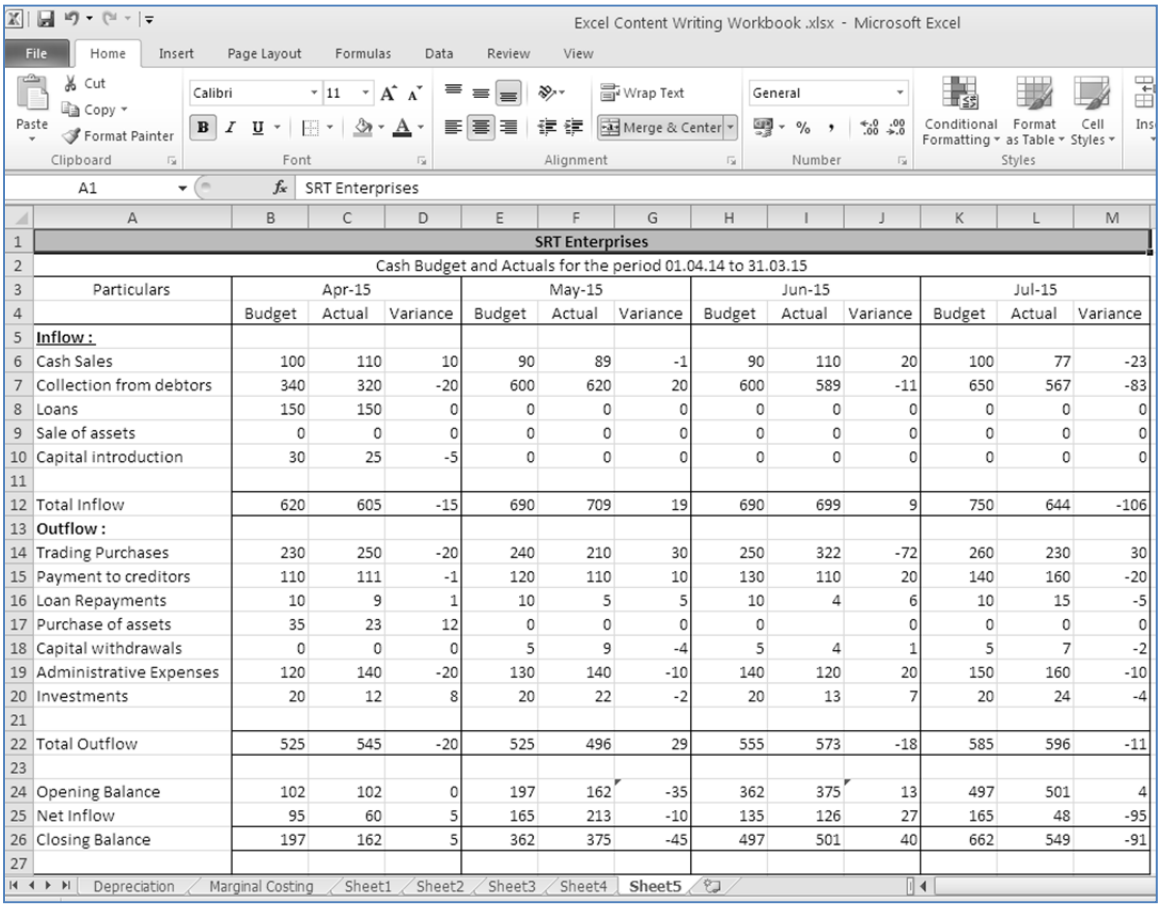
Requirements for preparation of cash budget in Excel:

- Knowledge of accounting
- Knowledge of formatting an excel sheet
- Knowledge of cell linking
- Knowledge of basic formulae

Figure under each head of inflow and outflow may be brought from a separate sheet, e.g. Cash Sales may be brought from Sales Budget Sheet, Loan Repayment figures may be brought from separate loan repayment schedule. These figures should be linked with the cells in other sheet so as to update the data on real time basis, automatically.

5.4.1 Budget & Actual

Purpose of any budget is not fulfilled till the time budget figures are compared with actuals and a suitable corrective action is taken, if required. A budget with actual figures along with variance can be prepared as shown in Fig 5.4.2.



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	SRT Enterprises												
2	Cash Budget and Actuals for the period 01.04.14 to 31.03.15												
3	Particulars	Apr-15			May-15			Jun-15			Jul-15		
4		Budget	Actual	Variance	Budget	Actual	Variance	Budget	Actual	Variance	Budget	Actual	Variance
5	**Inflow :**												
6	Cash Sales	100	110	10	90	89	-1	90	110	20	100	77	-23
7	Collection from debtors	340	320	-20	600	620	20	600	589	-11	650	567	-83
8	Loans	150	150	0	0	0	0	0	0	0	0	0	0
9	Sale of assets	0	0	0	0	0	0	0	0	0	0	0	0
10	Capital introduction	30	25	-5	0	0	0	0	0	0	0	0	0
11													
12	Total Inflow	620	605	-15	690	709	19	690	699	9	750	644	-106
13	**Outflow :**												
14	Trading Purchases	230	250	-20	240	210	30	250	322	-72	260	230	30
15	Payment to creditors	110	111	-1	120	110	10	130	110	20	140	160	-20
16	Loan Repayments	10	9	1	10	5	5	10	4	6	10	15	-5
17	Purchase of assets	35	23	12	0	0	0	0		0	0	0	0
18	Capital withdrawals	0	0	0	5	9	-4	5	4	1	5	7	-2
19	Administrative Expenses	120	140	-20	130	140	-10	140	120	20	150	160	-10
20	Investments	20	12	8	20	22	-2	20	13	7	20	24	-4
21													
22	Total Outflow	525	545	-20	525	496	29	555	573	-18	585	596	-11
23													
24	Opening Balance	102	102	0	197	162	-35	362	375	13	497	501	4
25	Net Inflow	95	60	5	165	213	-10	135	126	27	165	48	-95
26	Closing Balance	197	162	5	362	375	-45	497	501	40	662	549	-91
27													

Fig 5.4.2: A Budget with actual figures

5.4.2 Budget Template

Excel provides a readymade template for preparation of personal monthly budget, which may be used as it or along with modifications as required. Follow the steps as given under.

(a) Open a new or any existing excel file.

(b) Right click on any sheet tab.

(c) Click on “Insert”.

(d) Click on “Spreadsheet Solutions” tab.

(e) Double click on Personal Monthly Budget to open it.

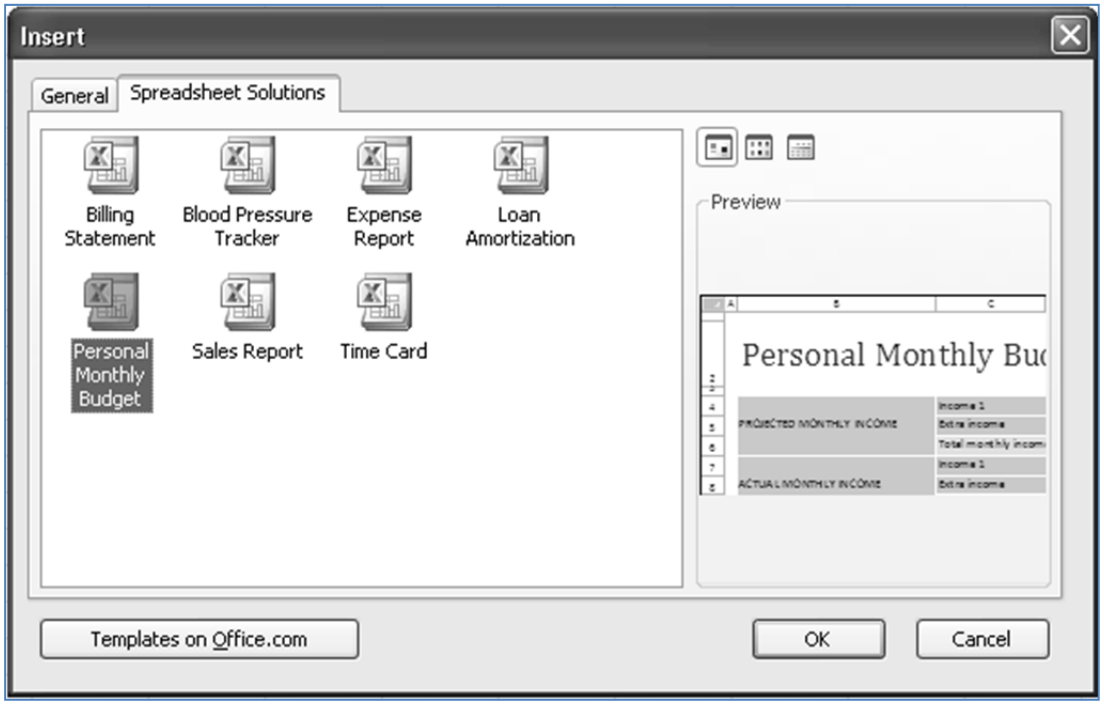


Fig 5.4.3: Budget Template

(f) Following format of budget shall get opened on your screen.

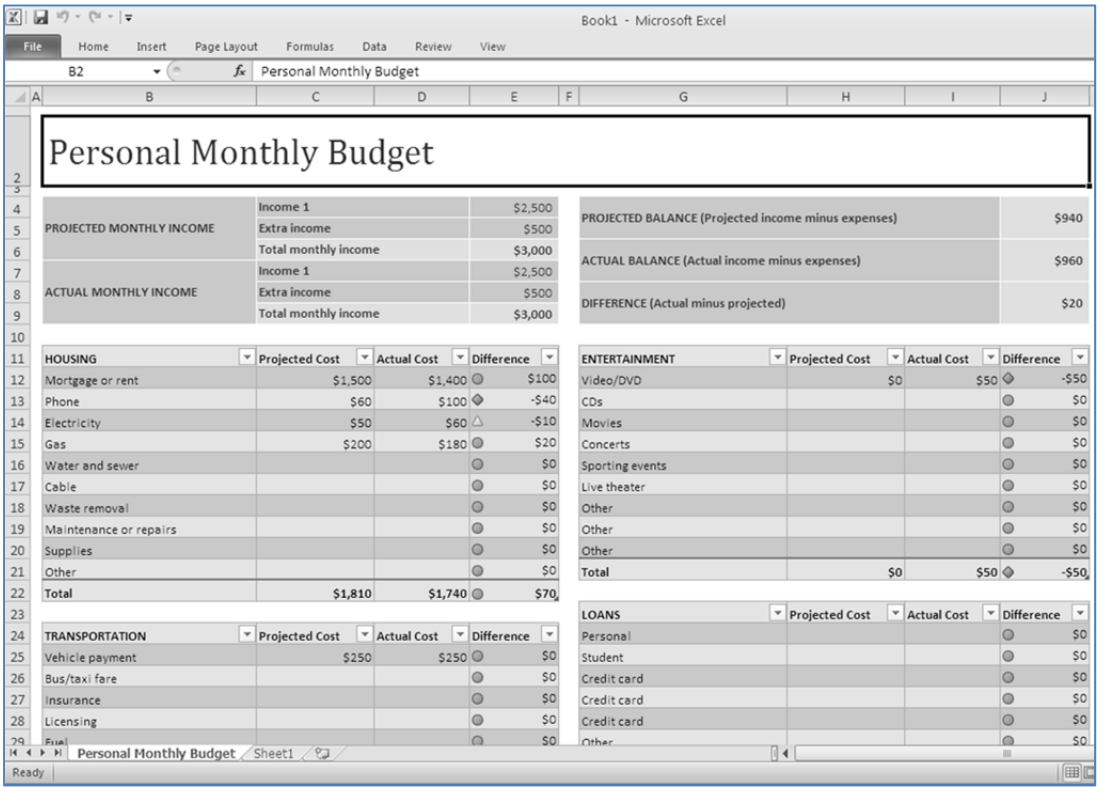


Fig 5.4.4: Format of Budget

5.5 Discounting

Discounting is the process of determining the present value of a payment or a stream of payments that is to be received in the future. Given the time value of money, a rupee is worth more today than it would be worth tomorrow given its capacity to earn interest. Discounting is the method used to figure out how much these future payments are worth today.

Discounting is one of the core principals of finance and is the primary factor used in pricing a stream of cash flows, such as those found in a traditional bond or annuity. For example, the succession of coupon payments found in a regular bond is discounted by a certain interest rate and summed together with the discounted par value to determine the bond's current value.

5.5.1 Discounting Factor

A discount factor can be thought of as a conversion factor for time value of money calculations. Time value of money calculations are based on the principle that funds placed in a secure investment earn interest over time.

In the past, it was common to refer to a discount factor table to look up the number needed to perform a time value of money conversion. With the use of calculators and spreadsheets, the table lookup technique is practically obsolete.

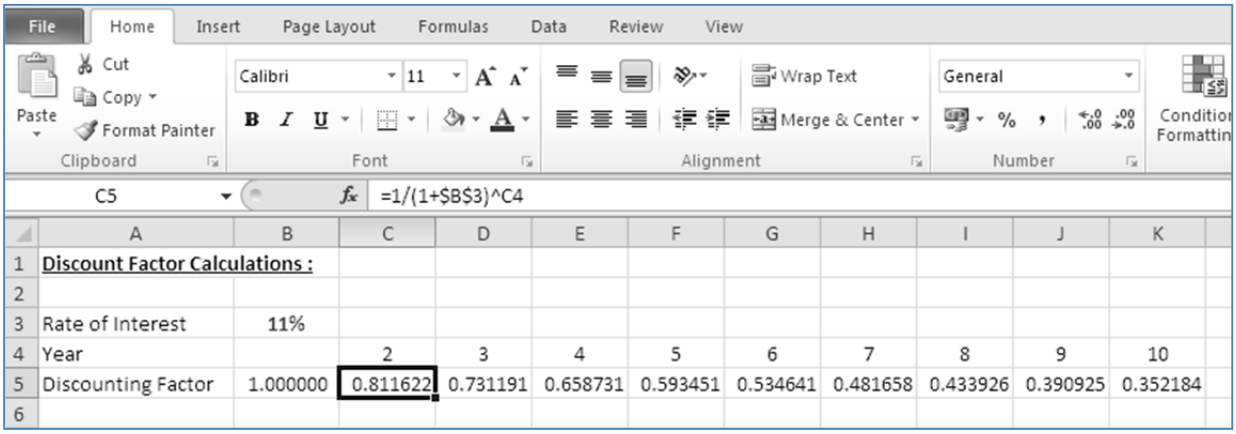
5.5.2 Using Excel for calculating Discounting Factor

Discounting factor can be calculated by using a simple formula as under

Discounting Factor = 1 / (1+r) ^ n

Where r = rate of interest and n = the year number for which discounting factor is to be calculated.

Let us consider a case where we wish to calculate the discounting factor for 10 years at interest rate of 11%. This can be done very easily in excel as shown in Fig 5.5.1.



	A	B	C	D	E	F	G	H	I	J	K
1	Discount Factor Calculations :										
2											
3	Rate of Interest	11%									
4	Year		2	3	4	5	6	7	8	9	10
5	Discounting Factor	1.000000	0.811622	0.731191	0.658731	0.593451	0.534641	0.481658	0.433926	0.390925	0.352184
6											

Fig 5.5.1: Calculating Discounting Factor

These discounting factors can be multiplied with cash flow values to get the present value of future cash flows.

Basically, discounting factors are used to calculate present value of future cash flows. One can get this even without calculated discounting factors. Many excel functions like PV, FV, IRR can be used to calculate the discounted value of cash flow without using the above mentioned formula. These functions are discussed later in other topics.

5.6 Tax Computations Using Excel

Excel can be conveniently used for preparation of tax computations. Let us prepare a computation sheet using some of the excel features.

1. File Creation

Create a new excel file and save it at desired location.

2. Sheet Formatting

Format the sheet as per requirement. Type the headings are required. Prepare the computation of income as per the required format without using any special excel function or feature. All types of controls and validation can be placed later on. A sample computation sheet is given for your reference as shown in Fig 5.6.1.

Assessee	**:**	**Shashank Prakash Deshpande**		**Assessment Year**	**:**	**2014-15**
PAN	**:**	**AFIPD0679G**		**Previous Year**	**:**	**2013-14**
Date of Birth	**:**	**17-03-1978**		**Status**	**:**	**Individual**
Computation of Income						
Income From Profession :						
Profit As Per Profit & Loss Account				7,55,542		
Less : Interest on Savings Account				3,994		
Less : Other Interest Income				7,496		
Less : Interest on Fixed Deposits				24,213		
Less : Share of Profit in Partnership Firm				68,055		
Total				6,51,784		6,51,784
Income From House Property :						
Annual Value (Self Occupied)				-		
Less :Deduction for Interest on Housing Loan (50% of 1,24,475)				62,238		(62,238)
Income From Other Sources :						
Interest on Savings Bank Account				3,994		
Interest on Fixed Deposits				24,213		
Interest other				7,496		35,703
Gross Total Income						6,25,250
Less : Deductions Under Chapter VI-A						
Principal Repayment on Housing Loan (50% of 140348)				70,174		
Kotak Life Insurance				4,437		
ELSS Mutual Fund				60,000		
Total Investment u/s 80C				1,34,611		
Total Deductions				1,34,611		1,00,000
Total Income						5,25,250
Less : Short Term Capital Gain						-
Taxable Income						**5,25,250**
Total income rounded off under section 288A						5,25,250
Tax on Above Income						35,050
Short Term Capital Gain Tax						-
Total Tax						35,050
Add: Eduction Cess @ 3%						1,052
Total Tax Payable						36,102
Add : Interest						-
Total Tax + Interest Payable						36,102
Less : Tax Deducted at Source						54,117
Refund Due						**(18,016)**
				Shashank Prakash Deshpande		
				(Assessee)		

Fig 5.6.1: Tax Computation using Excel

3. Sheet & Cell Protection

Once the basic format is ready, we can move towards locking the sheet / cells for editing. This will prevent the user from changing the sheet formatting, titles and thus disturbing the computation sheet. This can be done as shown in Fig 5.6.2 and Fig 5.6.3.

(a) By default all the cells in any excel sheet are locked. We must unlock the cells which we wish to keep open for users for data input. Select such cells and….

Right Click > Format Cells > Protection > Uncheck the "Locked" check box.

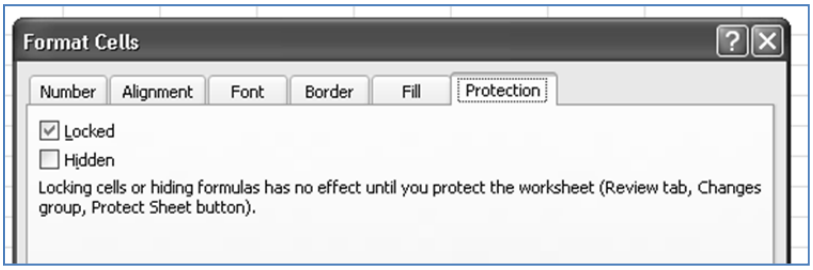


Fig 5.6.2: Unlock cell

Once this is done, the selected cells shall not be locked and other remaining cells shall be locked.

(b) Go to Review Tab> Protect Sheet. Type the password. Password is optional.

Fig 5.6.3: Password to Protect Sheet

This will ensure that the sheet is protected from all unwanted and unauthorized changes by users. The users shall be allowed to type or edit the text in selected fields only.

1. Setting Input Validations

(a) Date – Only date shall be entered in the filed for date of birth. This can be done by selecting the validation criteria as Date.

(b) PAN – PAN must have 10 characters only. Further, the first five characters shall be alphabets, next four characters shall be numbers and the last, i.e. 10th character shall be an alphabet only. For setting this type of validation, PAN has to be written in 10 different cells with 10 different validations.

(c) Value – Fields meant for typing figures, e.g. income shall allow only figures and not text. This can be done by selecting the validation criteria as "Whole number".

(d) Status – Status can be selected from the list of drop down option as Individual, Firm, Company, Society, etc. This can be done by using the validation criteria as "List". This

To set validation rules, go to Data > Validation. Any validation rule can be selected and set as per requirement as shown in Fig 5.6.4.

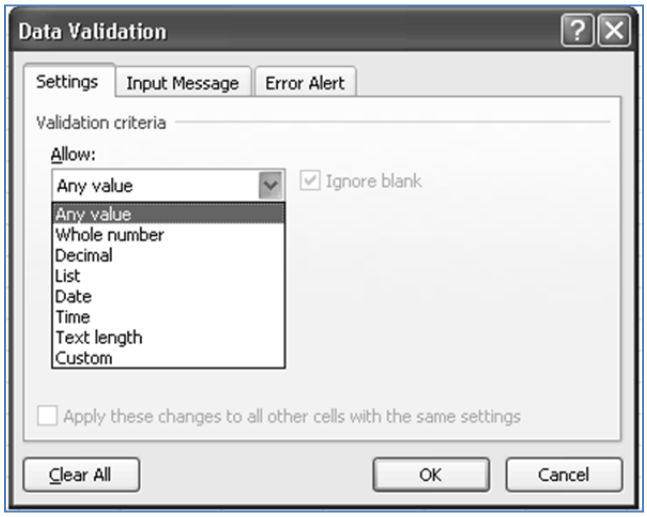


Fig 5.6.4: Data Validation

2. Tax Calculations

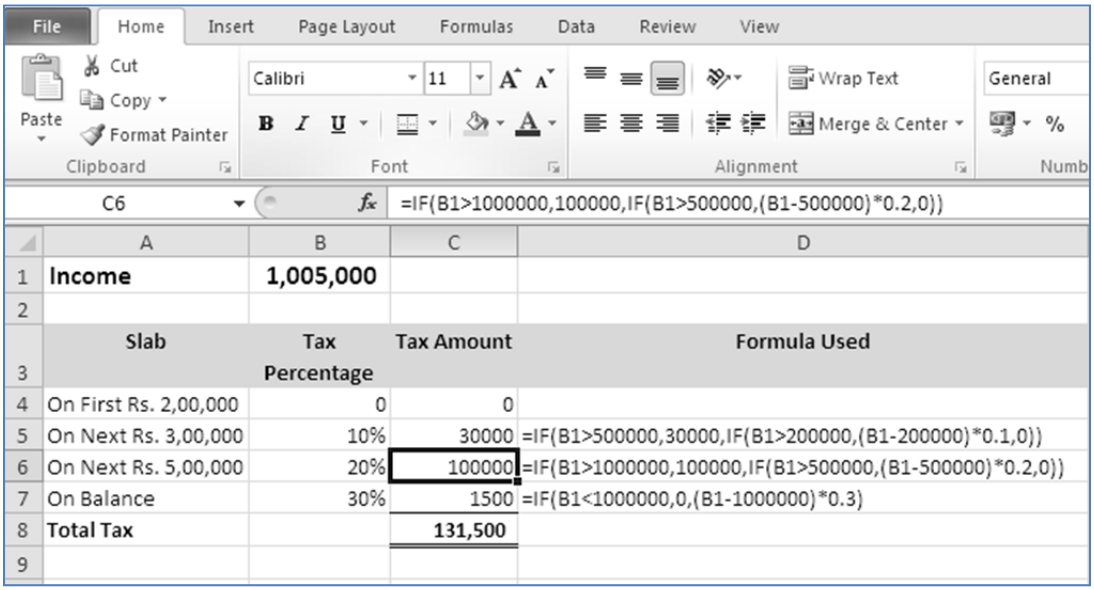
Method of tax calculations shall change according to status of assess, date of birth, etc. Let us consider a practical case as under.

Income : ₹ 11,62,500

Status : Individual (Age Below 60 Years)

Calculate the tax payable for AY 14-15

This can be easily done in excel using IF function as shown in Fig 5.6.5.



	A	B	C	D
1	**Income**	**1,005,000**		
2				
3	**Slab**	**Tax Percentage**	**Tax Amount**	**Formula Used**
4	On First Rs. 2,00,000	0	0	
5	On Next Rs. 3,00,000	10%	30000	=IF(B1>500000,30000,IF(B1>200000,(B1-200000)*0.1,0))
6	On Next Rs. 5,00,000	20%	100000	=IF(B1>1000000,100000,IF(B1>500000,(B1-500000)*0.2,0))
7	On Balance	30%	1500	=IF(B1<1000000,0,(B1-1000000)*0.3)
8	**Total Tax**		**131,500**	
9				

Fig 5.6.5: Tax Calculation

Explanation to formula used.

1. For 10% slab – Check if the income is greater than ₹ 5.00 lacs, if yes, the tax shall be ₹ 30,000. If no, then check if the income is greater than ₹ 2.00 lacs, if yes then tax shall be 10% of excess of income over ₹ 2.00 lacs). If income is even less than ₹ 2.00 lacs, the tax shall be zero.

2. For 20% slab – Check if income is greater than ₹ 10.00 lacs, if yes, then the tax shall be ₹ 1.00 lacs. If no, then check whether income is greater than ₹ 5.00 lacs, if yes, then tax shall be 20% of excess of income above ₹ 5.00 lacs. If income is not greater than ₹ 5.00 lacs, then tax shall be zero.

3. For 30% slab – Check if income is greater than ₹ 10.00 lacs, if No, tax shall be zero. If yes, tax shall be 30% of income above ₹ 10.00 lacs.

5.7 EMI Calculations Using Excel

EMI stands for equated monthly installment. This is very often needed in case of taking any type of finance decision. May it be lender or borrower, both the parties are always interested in knowing the amount of monthly installment that shall be payable. Installments are equated over the period of time for the sake of simplicity. There are certain points which need to be understood about EMI.

- Every installment amount shall include principal amount as well as interest amount.
- Interest amount shall be highest in the first EMI and lowest in the last EMI. Interest portion shall reduce gradually in every next EMI.
- Principal amount shall be lowest in the first EMI and highest in the last EMI. Principal portion shall increase gradually in every next EMI.

The biggest challenge in the above calculation is to how to change the proportion of principal and interest in every next EMI. This can be easily done using excel.

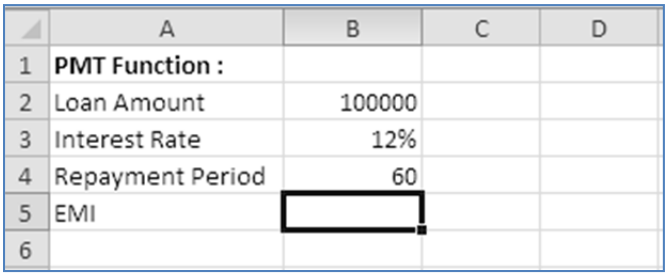
Case Study:

Mr. A want to avail a loan of ₹ 1.00 lacs. Repayment period is three years and rate of interest is 12% p.a. Please let him know what shall be the EMI.

Solution:

Equated Monthly Installment can be very easily calculated using PMT function as shown in Fig 5.7.1.

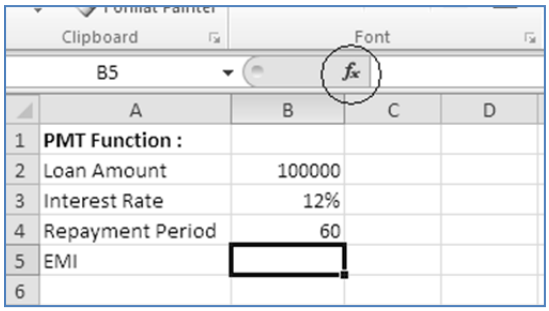
(a) Type the data in excel as given under.



	A	B	C	D
1	**PMT Function :**			
2	Loan Amount	100000		
3	Interest Rate	12%		
4	Repayment Period	60		
5	EMI			
6				

Fig 5.7.1: Using PMT function

(b) Select the cell where you want the result and click on the function button as shown in Fig 5.7.2



	A	B	C	D
1	**PMT Function :**			
2	Loan Amount	100000		
3	Interest Rate	12%		
4	Repayment Period	60		
5	EMI			
6				

Fig 5.7.2: Select the cell

Following screen shall appear after clicking on “fx” button as shown in Fig 5.7.3.

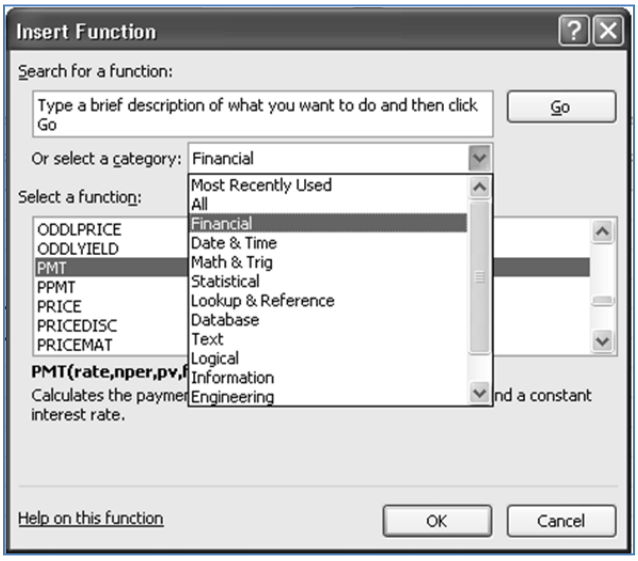


Fig 5.7.3: Screen of Financial function

Various types of functions are available in excel. Here the relevant function is "PMT" which stands for payment. This function is a part of Financial Functions in excel. Select the category as "Financial" and select "PMT" function.

After selecting "PMT" function, following screen shall appear as shown in Fig 5.7.4.

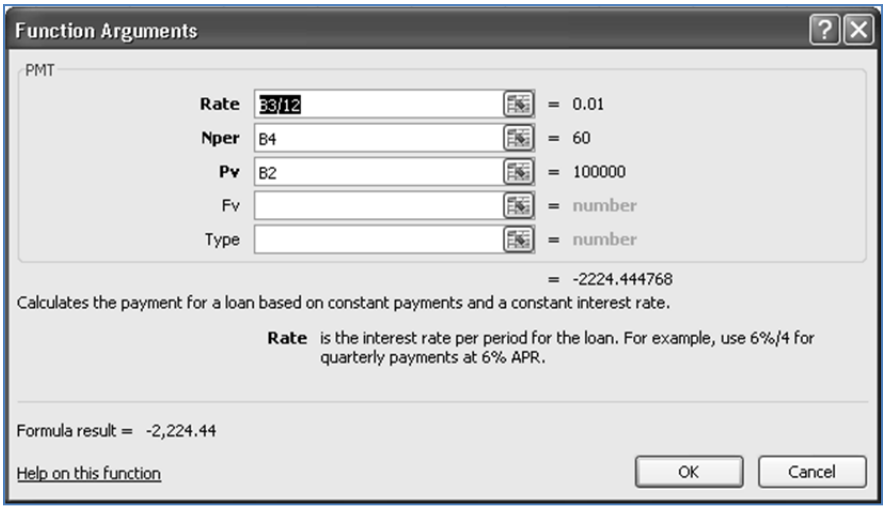


Fig 5.7.4: Selecting PMT function

- Rate – It is the rate of interest, to be divided by 12 for getting monthly rate of interest.
- Nper – It is total number of periods, i.e. 60 months in this case.
- PV – It is present value of cash flows, i.e. loan amount as on today.

All the above values can be typed or liked with cells in excel sheet for real time updation. As soon as all the values are entered / linked correctly, formula result is displayed at the bottom as ₹ 2,224.44. It is displayed as a negative figure just because excel considers all outflows are considered as negative figure. After clicking on OK button, the result shall be generated in the desired cell as shown in Fig 5.7.5.

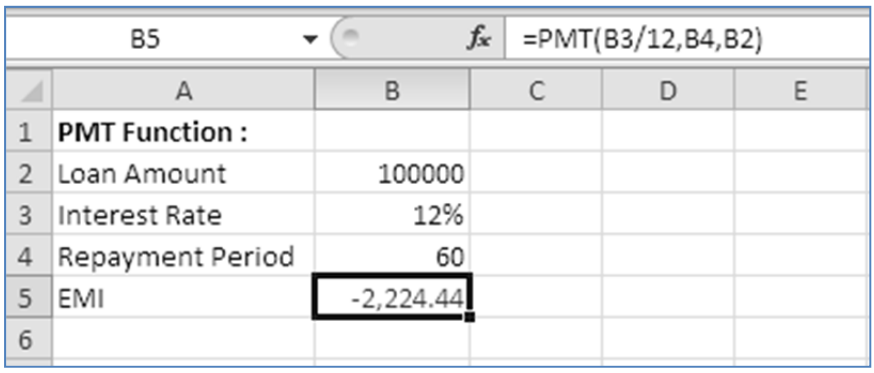


Fig 5.7.5: Result of PMT function

PPMT Function

This function is used to calculate the principal portion in every installment. This function requires one additional input, i.e. the installment number. The principal amount shall increase after every installment. Hence, principal amount shall be different in every EMI.

Continuing with the above example, the following figure shows calculation of principal and interest component in each EMI. Installment number is denoted by "Per" in excel.

For the calculation of interest component in each EMI, excel has IPMT function. Both the functions are used in the following figure.

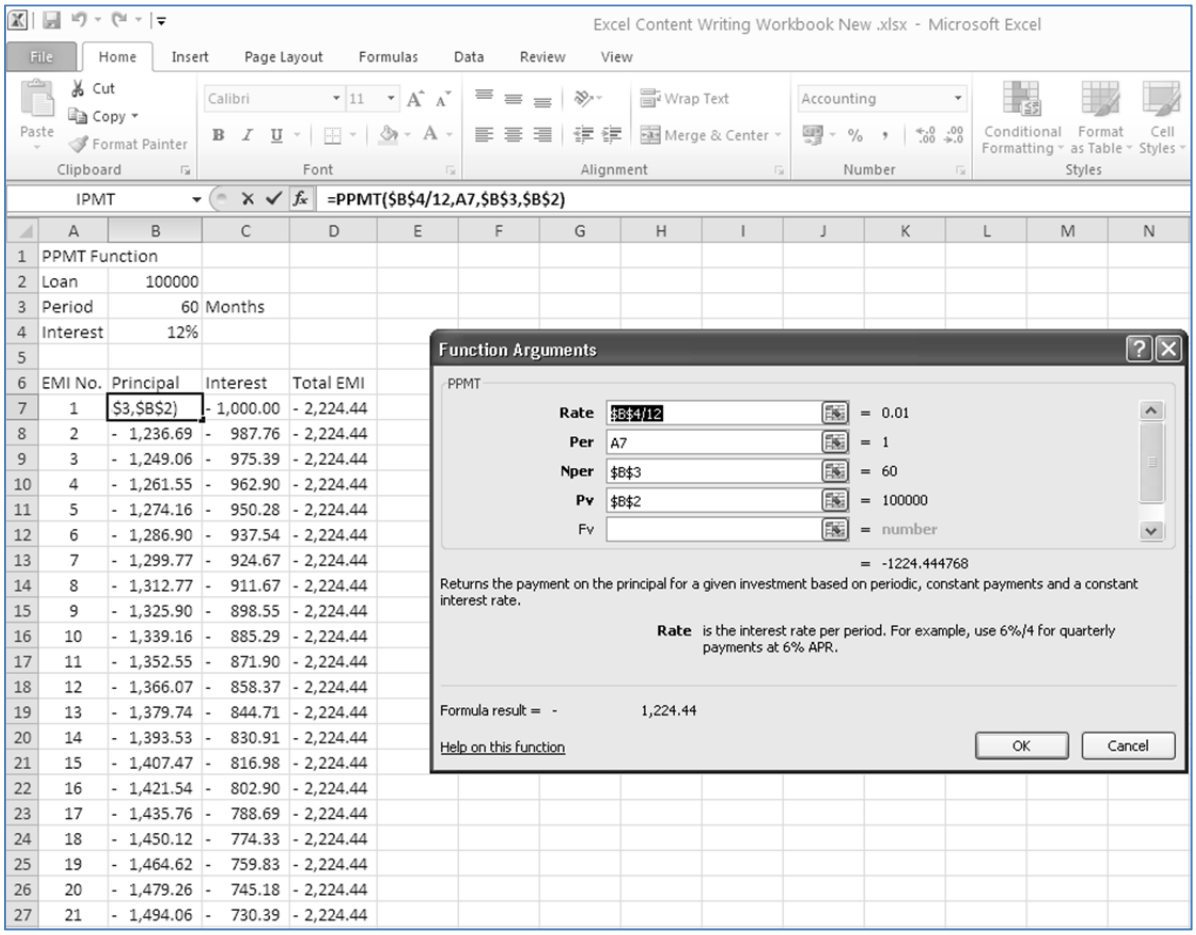


Fig 5.7.6: PPMT function

Loan Amortization Sheet

Excel provides a readymade solution for the EMI calculation. This can be simply done by following steps as shown in Fig 5.6.7.

(a) Open any excel file

(b) Right click on sheet tab.

(c) Select “Insert” option.

(d) Go to “Spreadsheet Solutions” tab

(e) Select “Loan Amortization” and click OK button.

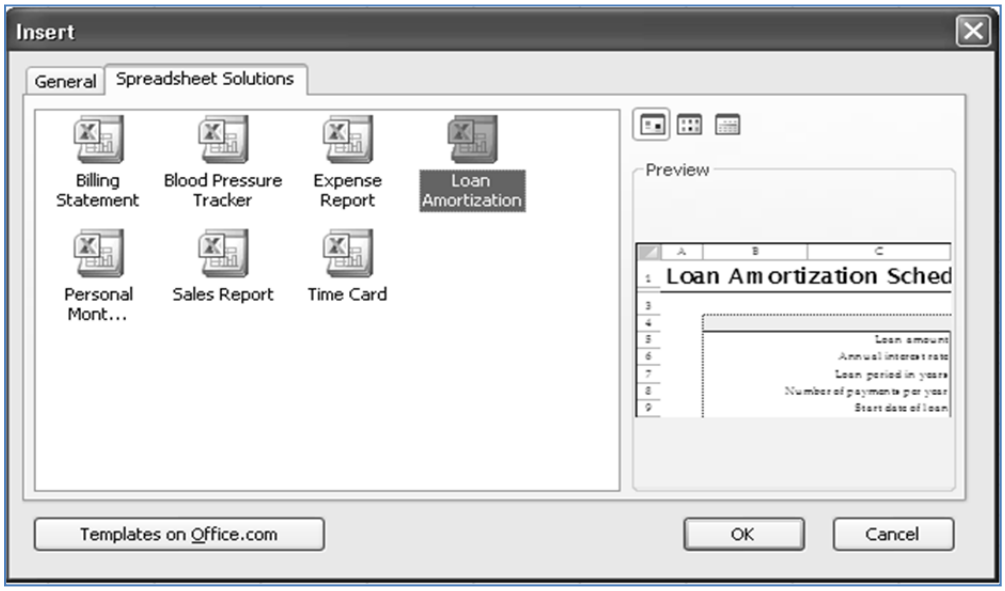


Fig 5.7.7: Loan Amortization Sheet template

(f) Enter all the details like Loan Amount, Annual interest rate, Loan period in years, Number of payment per year, Start date of loan, etc. All the EMI calculations shall be displayed as shown in Fig 5.7.8.

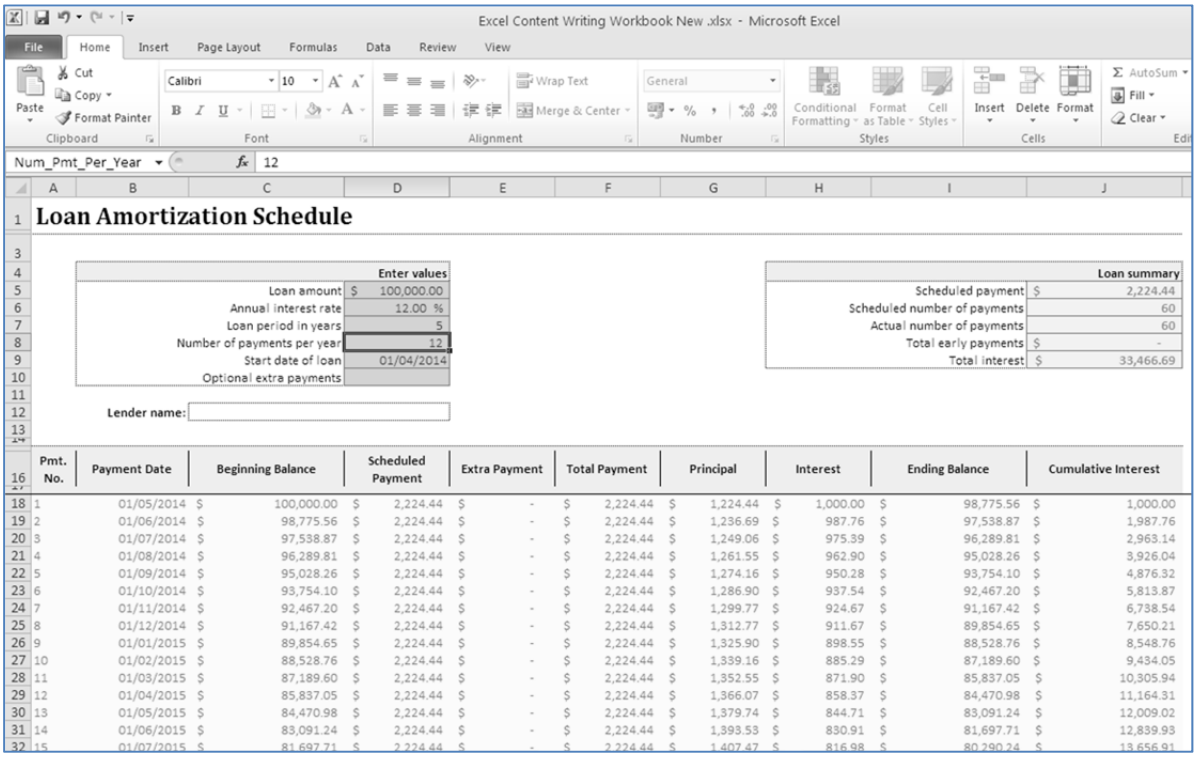


Fig 5.7.8: Loan Amortization Sheet template

5.8 Sampling

Sampling is the process of selecting units (e.g., people, organizations) from a population of interest so that by studying the sample we may fairly generalize our results back to the population from which they were chosen. Two words often used in sampling are sample and population. Sample means the units or items selected for study or consideration and population means the total set of data used for selection of samples.

Sampling is a process used in statistical analysis in which a predetermined number of observations will be taken from a larger population. The methodology used to sample from a larger population will depend on the type of analysis being performed, but will include simple random sampling, systematic sampling and observational sampling.

The basic expectation from sampling is that the sample should be a representation of the general population.

When taking a sample from a larger population, it is important to consider how the sample will be drawn. To get a representative sample, the sample must be drawn randomly and encompass the entire population. For example, a lottery system can be used to determine the average age of students in a college by sampling 20% of the students, considering an equal number of students from each type of course.

5.8.1 Sampling Randam Methods

Following are some of the sampling methods.

1. Simple Random Sampling: In this case each individual is chosen entirely by chance and each member of the population has an equal chance, or probability, of being selected. One way of obtaining a random sample is to give each individual in a population a number, and then use a table of random numbers to decide which individuals to include.

2. Systematic Sampling: Individuals are selected at regular intervals from a list of the whole population. The intervals are chosen to ensure an adequate sample size. For example, every 10th member of the population is included. This is often convenient and easy to use, although it may also lead to bias.

3. Stratified Sampling: In this method, the population is first divided into sub-groups (or strata) who all share a similar characteristic. It is used when we might reasonably expect the measurement of interest to vary between the different sub-groups. Gender or smoking habits would be examples of strata. The study sample is then obtained by taking samples from each stratum.

In a stratified sample, the probability of an individual being included varies according to known characteristics, such as gender, and the aim is to ensure that all sub-groups of the population that might be of relevance to the study are adequately represented.

The fact that the sample was stratified should be taken into account at the analysis stage.

4. Clustered Sampling: In a clustered sample, sub-groups of the population are used as the sampling unit, rather than individuals. The population is divided into sub-groups, known as clusters, and a selection of these are randomly selected to be included in the study. All members of the cluster are then included in the study. Clustering should be taken into account in the analysis.

The General Household survey, which is undertaken annually in England, is a good example of a cluster sample. All members of the selected households/ clusters are included in the survey.

5. Quota Sampling: This method of sampling is often used by market researchers. Interviewers are given a quota of subjects of a specified type to attempt to recruit. For example, an interviewer might be told to go out and select 20 adult men and 20 adult women, 10 teenage girls and 10 teenage boys so that they could interview them about their television viewing. There are several flaws with this method, but most importantly it is not truly random.

6. Convenience Sampling: Convenience sampling is perhaps the easiest method of sampling, because participants are selected in the most convenient way, and are often allowed to chose or volunteer to take part. Good results can be obtained, but the data set may be seriously biased, because those who volunteer to take part may be different from those who choose not to.

7. Snowball Sampling: This method is commonly used in social sciences when investigating hard to reach groups. Existing subjects are asked to nominate further subjects known to them, so the sample increases in size like a rolling snowball. For example, when carrying out a survey of risk behavior amongst intravenous drug users, participants may be asked to nominate other users to be interviewed.

5.8.2 Simple Random Sampling in Excel

Consider a small case of analysis of customer feedback about a product. Let us assume that we have a population of 1000 customer feedback forms. We need to analyze the feedback pattern of 5% customer, .i.e. 50 customers.

This can be done easily by following steps as under shown in Fig 5.8.1.

(a) Write Column heading in Cell A1 as Customer IDs and write customer codes / IDs in Cell A2, A3,A4, and so on.

(b) Go the cell B1 and write the column heading as Random Numbers.

(c) Go to cell B2 and type “Rand()” and press ENTER. This is a function for generating random numbers in any particular cell. After pressing ENTER, a random number shall be generated in cell B2.

(d) Copy Cell B2 and paste it in the Cells B3, B4, B5, etc. Now in-front of every customer ID, there is a random number.

(e) Sort both columns according to random numbers

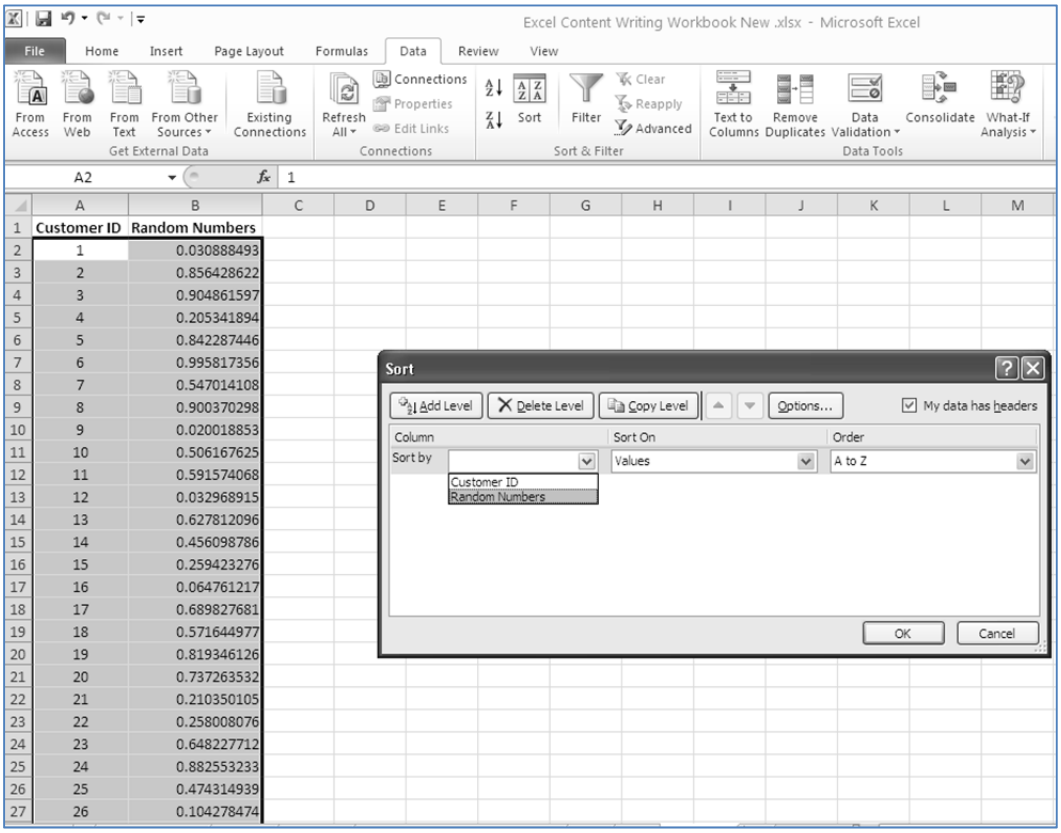


Fig 5.8.1: Simple Random Sampling

(f) Select the first 50 customers. Now these 50 customers are the randomly selected customers and represent the complete data.

5.8.3 Using Sampling Feature

Excel has got a built in feature for sampling of data. This can be used as under.

(a) Type the data regarding roll number of students in Cell A2, A3, A4, and so on.

(b) To get a sample of five students, go to Data > Data Analysis

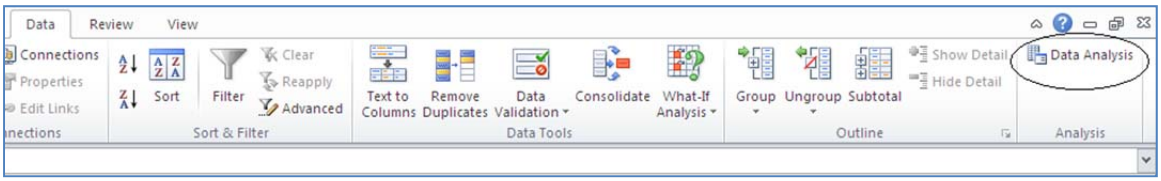


Fig 5.8.2: Sampling Feature

(c) Select “Sampling” from the list and click OK.

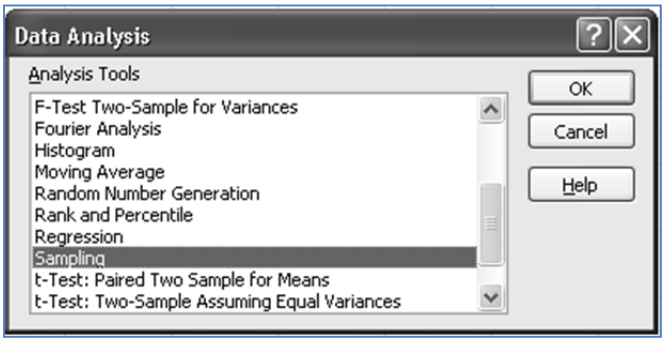


Fig 5.8.3: Select Sampling

(d) Following screen shall appear.

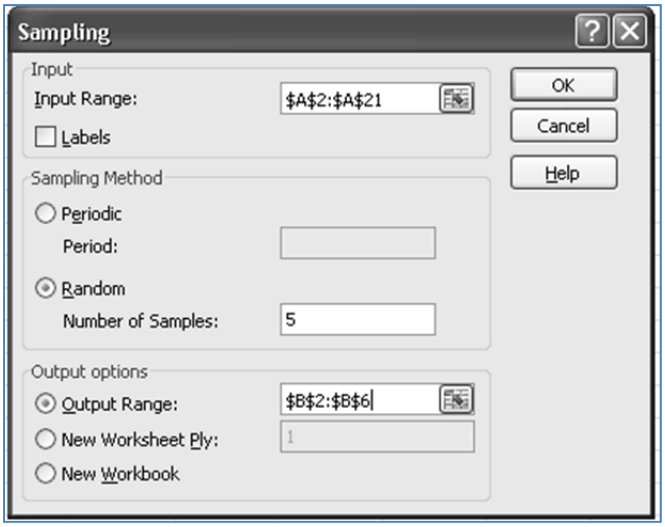
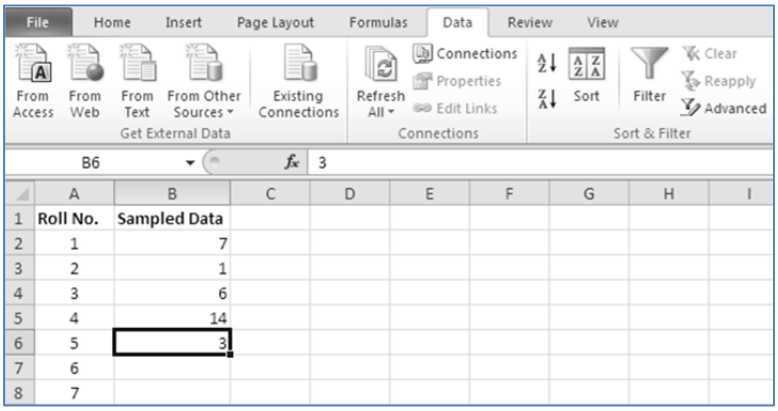


Fig 5.8.4: Sampling

There are three options for user to set.

- Input Range – Specify the population range here.
- Sampling Method – Select the method from two options. If periodic is selected, period, i.e. interval needs to be specified. If random is selected, number of samples required from the population has to be specified.
- Output options – Specify the location where you want the sampled data. It may the specific location in the same sheet, or some other sheet or in a new file also.

(e) Click OK to get the result. Following type of screen shall be generated. In this case we have considered a population of twenty students and we are obtaining samples of five students.



	A	B	C	D	E	F	G	H	I
1	Roll No.	Sampled Data							
2	1	7							
3	2	1							
4	3	6							
5	4	14							
6	5	3							
7	6								
8	7								

Fig 5.8.5: Obtained Sampling

5.9 Summary

Summary reports are useful for quick reading and easy understanding, particularly for top management. When excel is used for preparation of reports in similar formats, it can be used for consolidation of reports into a master report or a summary report. Additional operations like average, count, sum can be done while preparing summary reports.

To summarize and report results from data on separate worksheets, you can consolidate the data from each separate worksheet into one worksheet (or master worksheet). The worksheets you consolidate can be in the same workbook as the master worksheet or in other workbooks. When you consolidate data in one worksheet, you can more easily update and aggregate it on a regular or ad hoc basis.

For example, if you have a worksheet of expense figures for each of your regional offices, you might use data consolidation to roll up these figures into a corporate expense worksheet. This master worksheet might contain sales totals and averages, current inventory levels, and highest selling products for the entire enterprise.

Example:

Let us consider a case where the data about debtors for two months is stored in two different sheets. We wish to consolidate the data in third sheet.

Solution:

Let us assume that names of debtors are stored in Cell A2, A3, A4, and so on and monthly purchases by them are recorded in Cells B2, B3, B4, and so on. Data for the month of April is stored in Sheet1 and data for May is stored in Sheet2. Let us consolidate the data in Sheet3.

(a) Create a new sheet and rename it as Summary.

(b) Go to Data > Consolidate (Under Data Tools Group)

(c) Following type of screen shall appear as shown in Fig 5.9.1.

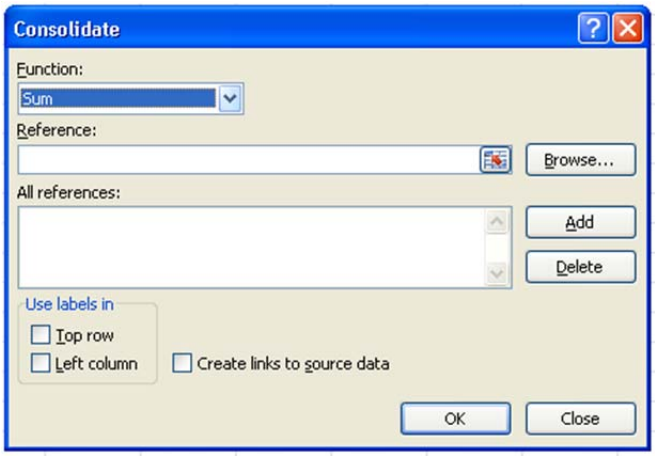


Fig 5.9.1: Consolidate Data

(d) Select the required function from the drop down menu. Here we have selected Sum.

(e) Select the table array (A2:B11) from Sheet1 in Reference and click on Add button.

(f) Now, select the reference (A2:B11) from Sheet2 in Reference and click on Add button.

(g) As we have stored the names of customer in A column, check the check box “Left column”

(h) Click on OK button. The result shall be generated on “Summary” sheet.

(i) If the check “Create links to source data” is clicked, summary report shall be linked with source data on real time basis. Updations in Sheet1 or Sheet2 shall be updated in Summary sheet also.

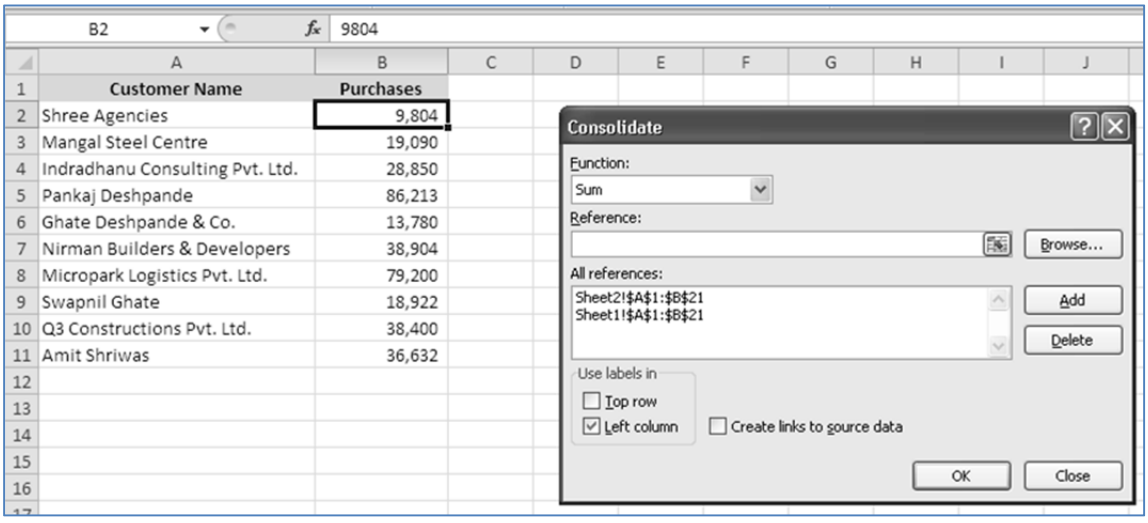


Fig 5.9.2: Create links to source data

Data can be summaries by using the Consolidate command (Data tab, Data Tools group). Other way of data consolidation is using formulae like COUNTIF, SUMIF, etc. or a PivotTable report also.

5.10 Capital Budgeting

It is a process in which a business determines whether projects such as building a new plant or investing in a long-term venture are worth pursuing. Oftentimes, a prospective project's lifetime cash inflows and outflows are assessed in order to determine whether the returns generated meet a sufficient target benchmark.

Ideally, businesses should pursue all projects and opportunities that enhance shareholder value. However, because the amount of capital available at any given time for new projects is limited, management needs to use capital budgeting techniques to determine which projects will yield the most return over an applicable period of time.

Popular methods of capital budgeting include net present value (NPV), internal rate of return (IRR), discounted cash flow (DCF) and payback period. Obviously excel can be of great use in Capital Budgeting. Let us understand each of these concepts and its calculation in excel.

5.10.1 Net Present Value

Net present value is the value of all future cash inflows less future cash outflows as on today. This is a major point in capital budgeting decisions. Net present value can be calculated in excel using two ways.

(a) By calculating discounting factors – Consider the following example where project future cash flows are given for five years. In the year zero, i.e. beginning of year one, ₹ 1000 is shown as outflow, which is initial investment. Positive figures in year 2,3,4,5 shows net cash inflows. To calculate the discounted cash flow, discounting factor is calculated in row six. Row seven shows present value of cash flows. Cell F8 shows the net present value of all the future cash flows, i.e. ₹ 402.

	A	B	C	D	E	F	G	H	I	J	K	L
1	**NPV Calculations**				Year	0	1	2	3	4	5	
2		**Assumptions**										
3		Discounting Rate		11%								
4		Cash Flows				-1000	200	300	400	500	600	
5												
6			Discounting Rate			1	0.900901	0.811622	0.731191	0.658731	0.593451	
7			Present Value			- 1,000	180	243	292	329	356	
8			Net Present Value			402						
9												

Fig 5.10.1: Net Present value

(b) By using NPV function – A readymade function is available in excel for calculation of Net Present Value. The function NPV uses the syntax as under. Using NPV function, NPV can be directly calculated without calculating discounting factors. The following figure shows NPV calculation of cash flows for all the five years in Cell L9. Formula bar below shows the syntax of NPV function.

L9 =NPV(D3,G4,H4,I4,J4,K4)

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	NPV Calculations				Year	0	1	2	3	4	5		
2		Assumptions											
3		Discounting Rate		11%									
4		Cash Flows				-1000	200	300	400	500	600		
5													
6			Discounting Rate			1	0.900901	0.811622	0.731191	0.658731	0.593451		
7			Present Value			- 1,000	180	243	292	329	356	1,401.58	
8			Net Present Value			402							
9												1,401.58	
10													

Fig 5.10.2: NPV function

5.10.2 Internal Rate of Return

The discount rate often used in capital budgeting that makes the net present value of all cash flows from a particular project equal to zero. Generally speaking, the higher a project's internal rate of return, the more desirable it is to undertake the project. As such, IRR can be used to rank several prospective projects a firm is considering. Assuming all other factors are equal among the various projects, the project with the highest IRR would probably be considered the best and undertaken first.

To calculate IRR using excel –

(a) Click on function button and select IRR function as shown in Fig 5.10.3.

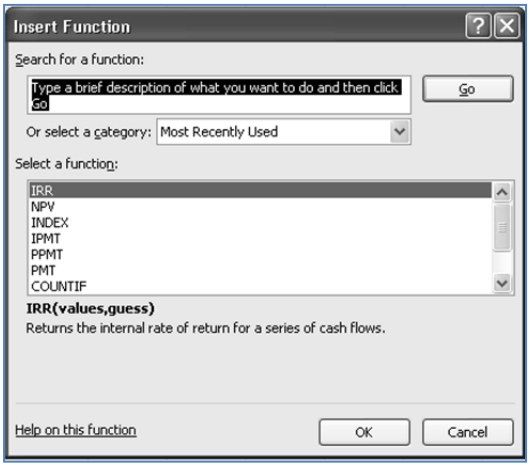


Fig 5.10.3: IRR function

(b) Following screen shall be displayed after selecting IRR function as shown in Fig 5.10.4.

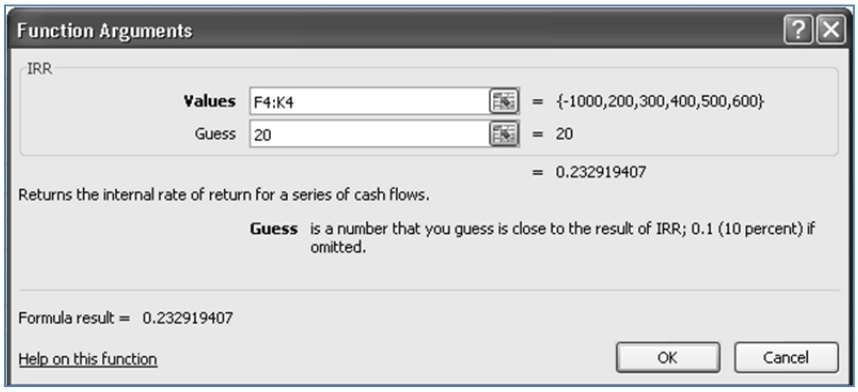


Fig 5.10.4: Screen display after selecting IRR function

Values – Input the cash flow values here or give a range.

Guess – Type any number that you guess is close to IRR.

Here IRR is calculated as 23.29% as shown in Fig 5.10.5

	A	B	C	D	E	F	G	H	I	J	K	L	M
3		Discounting Rate		23.29%									
4		Cash Flows				-1000	200	300	400	500	600		
5													
6			Discounting Rate			1	0.811096	0.657876	0.533601	0.432801	0.351043		
7			Present Value			- 1,000	162	197	213	216	211	1,000.05	
8			Net Present Value			0							
9												1,000.05	
10			IRR	23.29%									
11													

Fig 5.10.5: Result of IRR function

(c) We can cross check this IRR by changing the Discount Rate in Cell D3 to 23.29%, automatically the Net Present Value becomes zero.

5.11 Risk Analysis & Investment

Risk analysis is the process of defining and analyzing the dangers to individuals, businesses and government agencies posed by potential natural and human-caused adverse events.

In quantitative risk analysis, an attempt is made to numerically determine the probabilities of various adverse events and the likely extent of the losses if a particular event takes place.

Qualitative risk analysis, which is used more often, does not involve numerical probabilities or predictions of loss. Instead, the qualitative method involves defining the various threats, determining the extent of vulnerabilities and devising countermeasures should an attack occur.

In case of investments, risk analysis is the study of the underlying uncertainty of a given course of investment action. Risk analysis refers to the uncertainty of forecasted future cash flows streams, variance of portfolio/stock returns, statistical analysis to determine the probability of a project's success or failure, and

possible future economic states. Risk analysts often work in tandem with forecasting professionals to minimize future negative unforeseen effects.

Almost all sorts of businesses require a minimum sort of risk analysis. For example, commercial banks need to properly hedge foreign exchange exposure of oversees loans while large department stores must factor in the possibility of reduced revenues due to a global recession. Risk analysis allows professionals to identify and mitigate risks, but not avoid them completely. Proper risk analysis often includes mathematical and statistical software programs.

5.11.1 Risk Analysis & Excel

Excel being spreadsheet software can be very effectively used for analysis of any type of data and risk analysis cannot be an exception. There can variety of ways of using excel for risk analysis.

5.11.2 Risk Analysis Using Charts

Charts are generally used to present information in a simple and better way. Charts can also be used to analyse the risk in a better way. Following figure shows how project, probability and its consequence can be explain in a simple and user friendly way using a chart as shown in Fig 5.11.1.

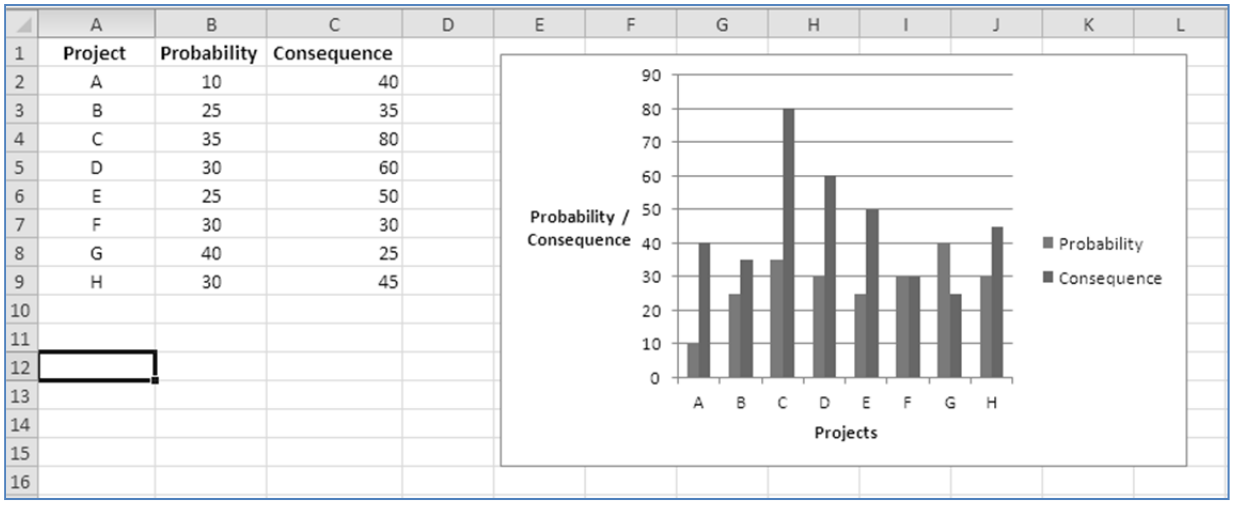


Fig 5.11.1: Risk Analysis using Charts

5.11.3 Probability

Probability is a measure of the likeliness that an event will occur.

Probability is used to quantify an attitude of mind towards some proposition of whose truth we are not certain. The proposition of interest is usually of the form "Will a specific event occur?" The attitude of mind is of the form "How certain are we that the event will occur?" The certainty we adopt can be described in terms of a numerical measure and this number, between 0 and 1 (where 0 indicates impossibility and 1 indicates certainty), we call probability. Thus,higher the probability of an event, the more certain we are that the event will occur. A simple example would be the toss of a fair coin. Since the 2 outcomes are deemed equi-probable, the probability of

"heads" equals the probability of "tails" and each probability is 1/2 or equivalently a 50% chance of either "heads" or "tails".

Example 1:

Let us consider a case where we want to calculate probability of achieving sales target between 70 to 80 units.

Follow the steps as under.

1. Create two column headings in excel files as under

   Cell A1 – "Sales Units"

   Cell B1 – "Probability"

2. Write the Sales Units in cells A2 to A7 as 50,60,70,80,90,100

3. Write the probability of each number in front of it, i.e. in Cells B2 to B7 as 0.05, 0.1, 0.4, 0.3, 0.1 and 0.05.

4. Get the cursor on Cell C2, i.e. the cell where we want to get the result.

5. Click on Function key and select PROB function

6. Set as the variables as shown in the figure below.

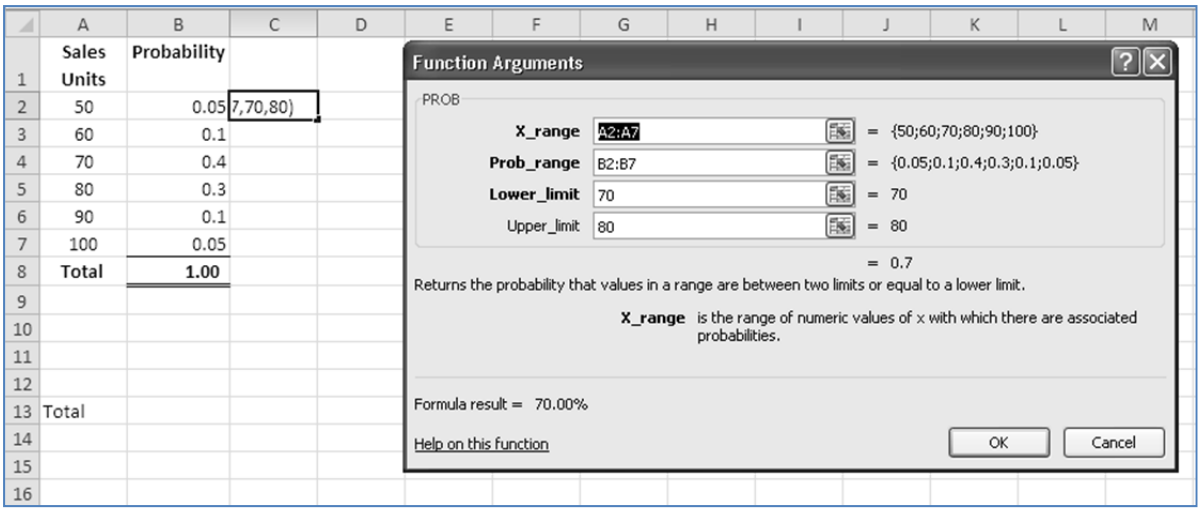


Fig 5.11.2: Calculate probability

7. Result will be generated in Cell C2 as "0.7". It means that there are 70% chances of achieving sales target anything between 70 to 80 units.

Note:

(a) X-range – The range of sales units

(b) Prob-range – The range of outcomes associates sales units.

(c) Lower Limit – Here we wish to set it as 70, anything out of the sales units can be selected here.

(d) Upper Limit – This field is optional. If ignored, it is considered as same as that of lower limit.

Example 2:

Using the same data, calculate the probability of achieving sales level of anything ranging from 50 to 100.

Solution:

1. Just click on Function Key once again and change the values of Lower & Upper Limit as 50 and 100 respectively.

2. Result generated is "1" or 100% if expressed in terms of percentage. It means, there are 100% chances of selling units between 50 to 100. In any case sales will not go below 50 units.

This type of information is useful in taking various decisions, e.g. How much to spend on marketing, how many salesman to be appointed, what should be the price of the product, etc.

In the similar way, probability of any particular outcome may be obtained just by changing lower and upper values.

5.11.4 Sensitivity Analysis

It is a technique used to determine how different values of an independent variable will impact a particular dependent variable under a given set of assumptions. This technique is used within specific boundaries that will depend on one or more input variables, such as the effect that changes in interest rates will have on a bond's price.

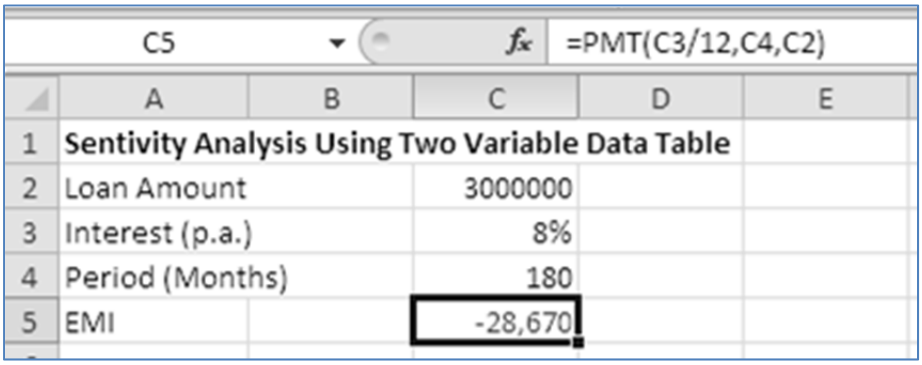
Sensitivity analysis is a way to predict the outcome of a decision if a situation turns out to be different compared to the key predictions.

Sensitivity analysis is very useful when attempting to determine the impact the actual outcome of a particular variable will have if it differs from what was previously assumed. By creating a given set of scenarios, the analyst can determine how changes in one variable will impact the target variable.

Example 1:

Consider a simple case of loan and EMI calculation. In case of EMI calculations, there are two variables, loan amount and interest rate. Sensitivity analysis can be used to check the impact on the EMI if both the variables, i.e. loan amount and interest rates are changed.

Input the data in excel sheet as under in Fig 5.11.3.



C5 | =PMT(C3/12,C4,C2)

	A	B	C	D	E
1	**Sentivity Analysis Using Two Variable Data Table**				
2	Loan Amount		3000000		
3	Interest (p.a.)		8%		
4	Period (Months)		180		
5	EMI		-28,670		

Fig 5.11.3: Sensitivity Analysis

EMI in the above sheet is calculated using PMT function.

Now, let us try to check the impact on EMI if interest rate varies from 7.5% to 9%. Also let us check the impact on EMI if loan amount changes from ₹ 15.00 Lacs to ₹ 50.00 Lacs. For this purpose, input the data as shown under.

Interest rates are written in Cells A8:A23 and Loan Amounts are written in Cells C7:I7.

	A	B	C	D	E	F	G	H	I	J
1	**Sentivity Analysis Using Two Variable Data Table**									
2	Loan Amount		3000000							
3	Interest (p.a.)		8%							
4	Period (Months)		180							
5	EMI		-28,670							
6										
7	-28,670	1,500,000	2,000,000	2,500,000	3,000,000	3,500,000	4,000,000	4,500,000	5,000,000	
8	7.50%									
9	7.60%									
10	7.70%									
11	7.80%									
12	7.90%									
13	8.00%									
14	8.10%									
15	8.20%									
16	8.30%									
17	8.40%									
18	8.50%									
19	8.60%									
20	8.70%									
21	8.80%									
22	8.90%									
23	9.00%									
24										
25										

Fig 5.11.4: Sensitivity Analysis Using Two variable data

Select the complete table from Cell A7 to Cell I23.

Go to Data > What-If Analysis > Data Table

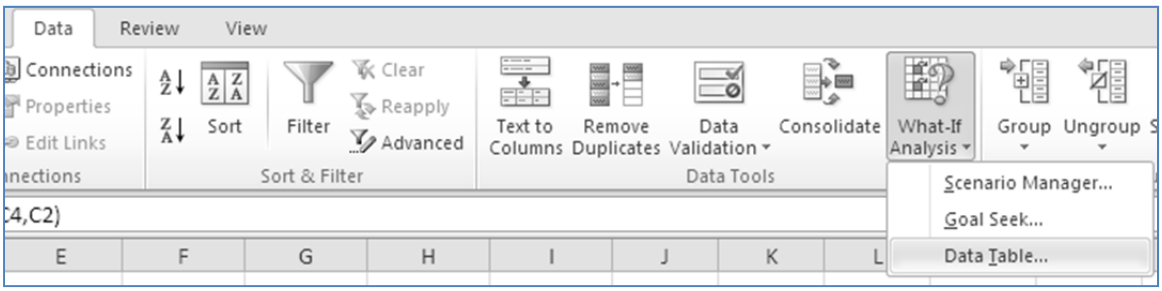
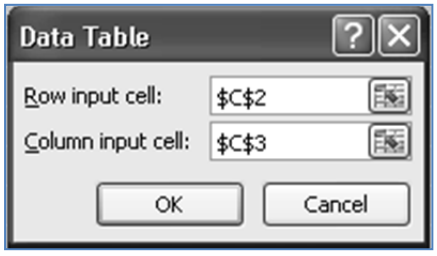


Fig 5.11.5: What-If Analysis

Select the row input cell as the cell where loan amount is stored and select the column input cell as the cell where interest rate is stored and press enter.



Following type of report shall be generated as shown in Fig 5.11.6.

	A	B	C	D	E	F	G	H	I	J
1	Sentivity Analysis Using Two Variable Data Table									
2	Loan Amount		3,000,000							
3	Interest (p.a.)		8%							
4	Period (Months)		180							
5	EMI		-28,670							
6										
7	-28,670	1,500,000	2,000,000	2,500,000	3,000,000	3,500,000	4,000,000	4,500,000	5,000,000	
8	7.50%	-13,905	-18,540	-23,175	-27,810	-32,445	-37,080	-41,716	-46,351	
9	7.60%	-13,991	-18,654	-23,318	-27,981	-32,645	-37,308	-41,972	-46,635	
10	7.70%	-14,076	-18,768	-23,460	-28,152	-32,844	-37,537	-42,229	-46,921	
11	7.80%	-14,162	-18,883	-23,604	-28,324	-33,045	-37,766	-42,486	-47,207	
12	7.90%	-14,248	-18,998	-23,747	-28,497	-33,246	-37,996	-42,745	-47,494	
13	8.00%	-14,335	-19,113	-23,891	-28,670	-33,448	-38,226	-43,004	-47,783	
14	8.10%	-14,422	-19,229	-24,036	-28,843	-33,650	-38,457	-43,265	-48,072	
15	8.20%	-14,509	-19,345	-24,181	-29,017	-33,853	-38,689	-43,526	-48,362	
16	8.30%	-14,596	-19,461	-24,326	-29,192	-34,057	-38,922	-43,787	-48,653	
17	8.40%	-14,683	-19,578	-24,472	-29,367	-34,261	-39,155	-44,050	-48,944	
18	8.50%	-14,771	-19,695	-24,618	-29,542	-34,466	-39,390	-44,313	-49,237	
19	8.60%	-14,859	-19,812	-24,765	-29,718	-34,671	-39,624	-44,577	-49,531	
20	8.70%	-14,947	-19,930	-24,912	-29,895	-34,877	-39,860	-44,842	-49,825	
21	8.80%	-15,036	-20,048	-25,060	-30,072	-35,084	-40,096	-45,108	-50,120	
22	8.90%	-15,125	-20,167	-25,208	-30,250	-35,291	-40,333	-45,375	-50,416	
23	9.00%	-15,214	-20,285	-25,357	-30,428	-35,499	-40,571	-45,642	-50,713	
24										

Fig 5.11.6: Generated report

It can be observed from the above table that in case of ₹ 30.00 lacs loan and rate of interest of 8% p.a., EMI comes to be ₹ 28,670, which matches with our original calculations. The complete data considering two variables is ready within few minutes.

5.11.5 Scenario Analysis

Scenario is a particular situation dependent on some events. Scenario analysis includes analysis of a situation considering happening or not happening of certain events. In financial world, particularly regarding investments, it is the process of estimating the expected value of a portfolio after a given period of time, assuming specific changes in the values of the portfolio's securities or key factors that would affect security values, such as changes in the interest rate.

Scenario analysis commonly focuses on estimating what a portfolio's value would decrease to if an unfavorable event, or the "worst-case scenario", were realized. Scenario analysis involves computing different reinvestment rates for expected returns that are reinvested during the investment horizon.

Example:

Consider a case of a furniture shop. You have 100 chairs in your shop. Chairs are sold to different customer at different prices, e.g. ₹ 4,000 to ₹ 6,000.

If we are selling 60% of chairs at highest price of ₹ 6,000 each and 40% chairs at lowest price of ₹ 4,000 each, following shall be the scenario.

A1 | fx | What If Analysis

	A	B	C	D	E	F
1	**What If Analysis**					
2	Total Chairs		100			
3	% Sold for Highest Price		60%			
4		No. of Chairs	Profit per Chair			
5	Highest Price	60	500			
6	Lowest Price	40	200			
7	Total Profit		38,000			
8						

Fig 5.11.7: Scenario Analysis

ANow consider what if you are selling 70% of chairs at highest price, or 80% of chairs at highest price or 90% or all the chairs at highest price. What will be the profit figure in each case ? This can be easily done by using scenario analysis.

- To create scenarios go to Data > What-If Analysis > Scenario Manager
- Click on Add button
  - Type some relevant name for scenario
  - Link the changing cell, i.e. the cell where % (C3 in this case) is written and click on OK button.

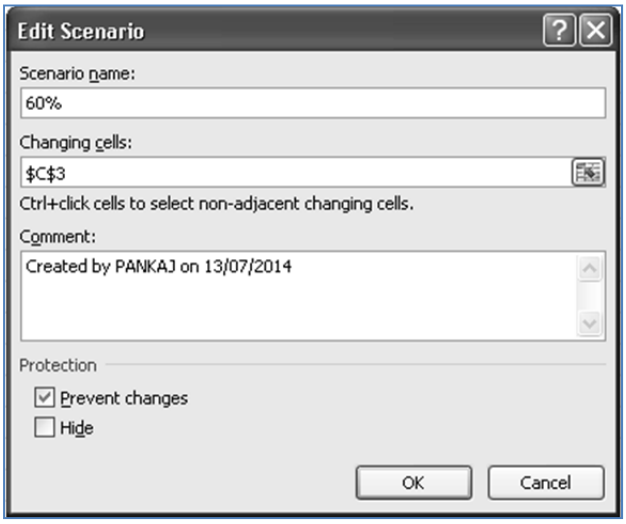


Fig 5.11.8: Edit Scenario

After clicking OK button, scenario value has to set in this screen. Type 0.6 as value.

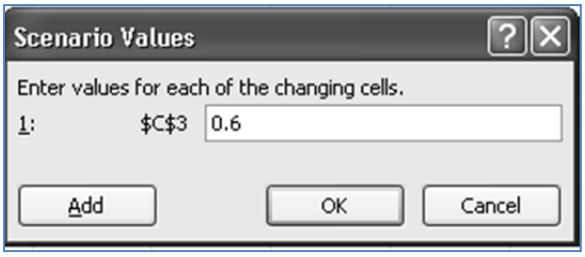


Fig 5.11.9: Scenario Value

Go on creating all the scenarios one by one for 70%, 80% 90% and 100%.

To see the changes in report, change the scenario and click on show button in Scenario Manager screen.

Note: Cell having % and number of chairs sold must be linked.

5.11.6 Certainty Equivalent Model

Certainty Equivalent can be considered as a guaranteed return that someone would accept, rather than taking a chance on a higher, but uncertain, return. If you've ever thought about leaving your job to start your own profession, and potentially make more money, but decided to stay and continue drawing a salary instead, then the amount of your salary is your certainty equivalent. You might need to come up with a business idea with a higher potential payoff to be convinced to leave the security of your existing job.

Investments must pay a risk premium to compensate investors for the possibility that they may not get their money back. If an investor has a choice between a Government bond paying 3% interest and a corporate bond paying 8% interest, and he chooses the government bond, the payoff is the certainty equivalent. The company would need to offer this particular investor a potential return of more than 8% on its bonds, to convince him to

buy. Thus, a company seeking investors can use the certainty equivalent as a basis for determining how much more it needs to pay, to convince investors to consider the riskier option. The certainty equivalent will vary, because each investor has a unique risk tolerance.

5.11.7 Decision Tree Analysis

It is a system where a schematic tree-shaped diagram is used to determine a course of action or show a statistical probability. Each branch of the decision tree represents a possible decision or occurrence. The tree structure shows how one choice leads to the next, and the use of branches indicates that each option is mutually exclusive.

A decision tree can be used to clarify and find an answer to a complex problem. The structure allows users to take a problem with multiple possible solutions and display it in a simple, easy-to-understand format that shows the relationship between different events or decisions. The furthest branches on the tree represent possible end results.

A decision tree is a kind of flowchart -- a graphical representation of the process for making a decision or a series of decisions. Businesses use them to determine company policy, sometimes simply for choosing what policy is, other times as a published tool for their employees. Individuals can use decision trees to help them make difficult decisions by reducing them to a series of simpler, or less emotionally laden, choices. Regardless of the context or type of decision, the structure of a decision tree remains the same. Or you can say A decision tree is a decision support tool that uses a tree-like graph or model of decisions and their possible consequences, including chance event outcomes, resource costs, and utility. It is one way to display an algorithm.

Example:

How to create a decision tree in excel?

Follow the steps as given here.

1. Open a new excel file and go to the "Insert" tab and click the "SmartArt" button. A window titled "Choose a SmartArt Graphic" will appear. Click the "Hierarchy" category and choose "Horizontal Labeled Hierarchy" design. Click "OK."
2. Type the name of the decision next to the first bullet point in the window that says "Type your text here." Type something like "Investment," if you are making an investment decision.
3. Type the names of each option in the indented bullet points under the decision bullet. For example, you are investing in a lump sum amount either with Government or in a private company. Evaluate each option and determine whether a result is achieved, if there is uncertainty, or if another decision needs to be made
4. Insert boxes wherever there is another decision to be made and circles for uncertainties. If there is a result, nothing needs to be done. Boxes can be added by pressing "Enter" and "Tab" after the bullet point where you would like to add a box. To change the shape to a circle, for example, right click on the shape, and select "Change Shape." Select a circle.

5. Enter probabilities in the closest cell where circles and lines join. The probabilities represent the percentage you expect to occur. Enter estimated values such as dollar values in the closest cell where boxes and lines are joined. These represent the estimated value of the decision if it is taken.

A sample decision tree can be prepared as shown in Fig 5.11.10.

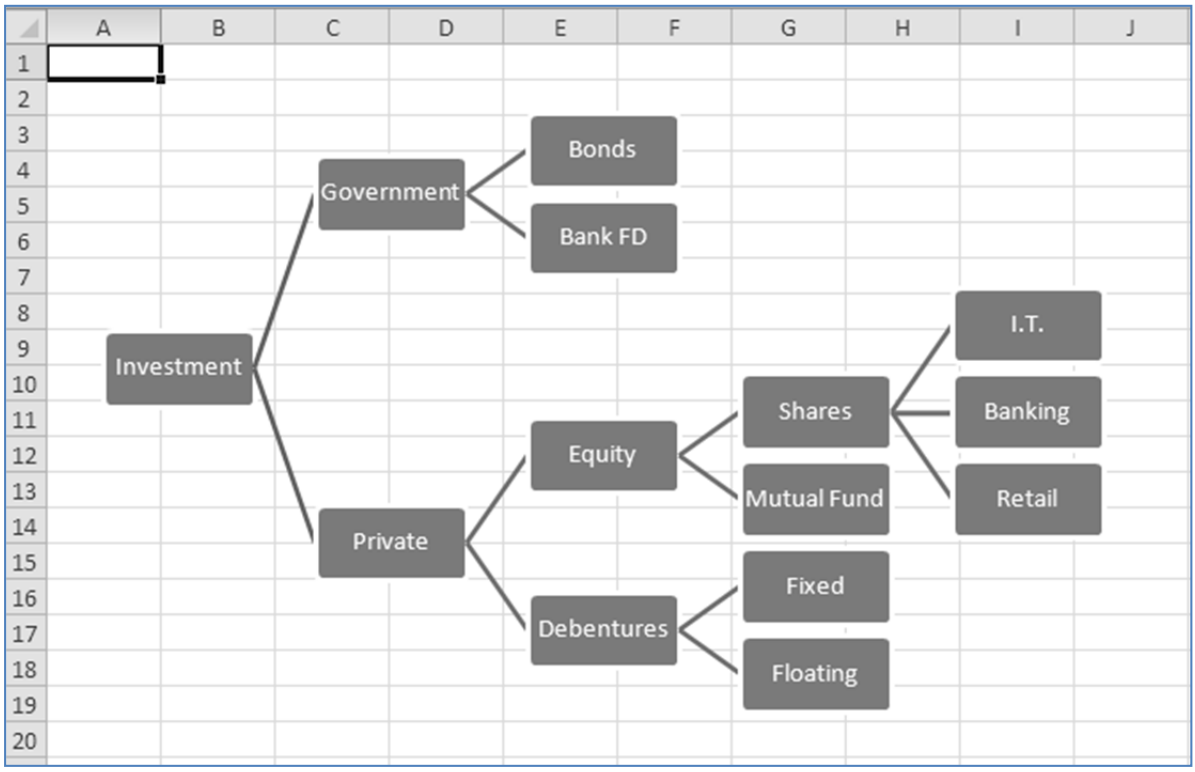


Fig 5.11.10: Sample decision tree

While considering an investment option, safety of money, returns and liquidity may be the criteria for evaluating each investment option.

5.11.8 Monte Carlo Simulation

A problem solving technique used to approximate the probability of certain outcomes by running multiple trial runs, called simulations, using random variables. Monte Carlo simulation is named after the city in Monaco, where the primary attractions are casinos that have games of chance. Gambling games, like roulette, dice, and slot machines, exhibit random behavior.

Monte Carlo simulation is a computerized mathematical technique that allows people to account for risk in quantitative analysis and decision making. The technique is used by professionals in such widely disparate fields as finance, project management, energy, manufacturing, engineering, research and development, insurance, oil & gas, transportation, and the environment.

Monte Carlo simulation furnishes the decision-maker with a range of possible outcomes and the probabilities

they will occur for any choice of action.. It shows the extreme possibilities—the outcomes of going for broke and for the most conservative decision—along with all possible consequences for middle-of-the-road decisions.

The technique was first used by scientists working on the atom bomb; it was named for Monte Carlo, the Monaco resort town renowned for its casinos. Since its introduction in World War II, Monte Carlo simulation has been used to model a variety of physical and conceptual systems.

5.12 Finance Planning

Planning is considered to be the primary requirement for moving towards any goal. Financial planning is the process of meeting the financial goals through the proper management of finances. Proper management of finances includes deciding the source and application of funds along with it timing. It is common for anybody to face financial setbacks at some point. One way to avoid or reduce the impact of such setbacks in the future is through careful financial planning. Financial goals can include buying a home, saving for your child's education or planning for retirement. The financial planning process involves the following steps:

There are two basic rules in any type of financial planning.

(a) Earlier the better – Money received today is always better than money received tomorrow.

(b) Bigger the better – More money received is always better than less money received.

5.12.1 Five Ds of Finance Planning:

1. Deciding the Objective : This is the first step in financial planning. One has to be clear about the objective of finance planning. This is basic step which decides and impacts all the future steps.

2. Data Collection : Once the objective is decided and clear, the next step is to collect the required data for analysis. Data can be obtained in any form, but mostly it will be in figures. Excel can be used for storing the data of any size very easily.

3. Data Analysis : This is a very important step in the overall process. This step requires huge amount of efforts and expertise. Excel can be very effectively used for analysis of data of any size and that too with great amount of ease. Data is evaluated as per the direction of financial objective.

4. Drawing Inference :This step invovles human intervention. Many a times this step is ignored. Every individual may have his/her own set of rules for drawing inferences. Two different individuals may draw two different inferences using the same set of data.

5. Decision Making : Once the inferenace is drawn, decision has to be taken about financial planning. Decision making involves taking action on the basis of four earlier steps.

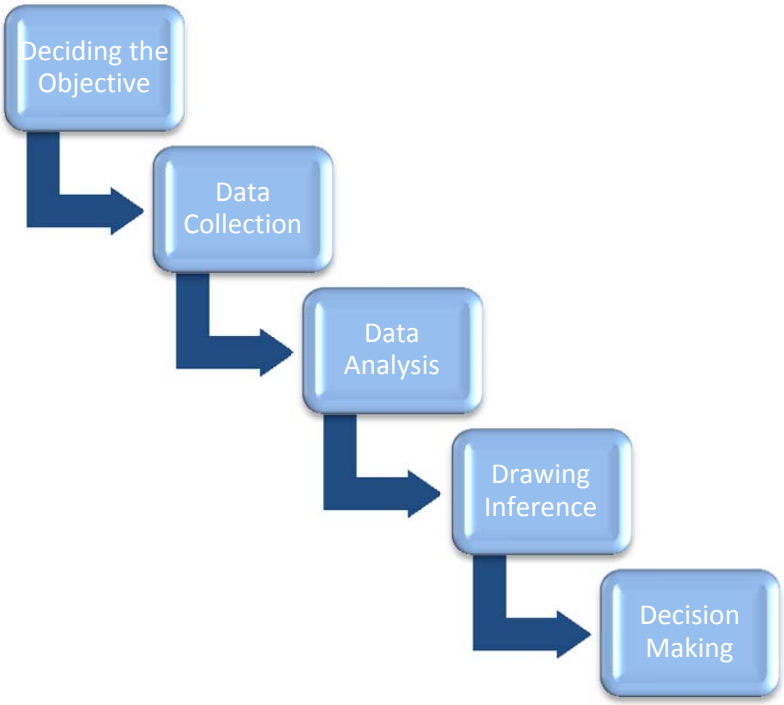


Fig 5.12.1: Five Ds of Finance Planning

5.12.2 Using Excel for Financial Planning

Various excel functions and features can be used in the process of financial planning. Some of the functions are listed below.

Sr. No.	Function	Use
1	PMT	Payment – Used for calculating monthly installment/investment amount.
2	PPMT	Principal Payment – Used for calculating principal amount in EMI
3	IPMT	Interest Payment – Used for calculating interest amount in EMI
4	FV	Future Value – Used for calculating future value of present investment
5	RATE	Rate – Used for calculating rate of interest
6	NPER	Number of Periods – Used for calculating number of periods (months/years) required for a particular maturity amount at a given rate of interest.
7	IRR	Internal Rate of Return – Used for
8	PV	Present Value – Used for calculating present value of future cash flows.

Table 5.12.1 Excel function for Financial Planning

5.13 Personal Financial Planning

Personal financial planning in case of most of the individuals shall include planning for retirement, decision about home loans, budgeting for major expenses like marriage of children, education expenses, etc.

Let us directly try to handle these commonly asked questions by individuals.

Example 1:

Mr. Swapnil Ghate is willing to invest ₹ 5,000 per month for the purpose of buying office space. He wants to know how much amount he would get at the end of 10 years considering a rate of interest of 8% p.a.

Solution:

This question can be answered very easily by using "FV" function.

Following shown in Fig 5.13.1 how this function can be used.

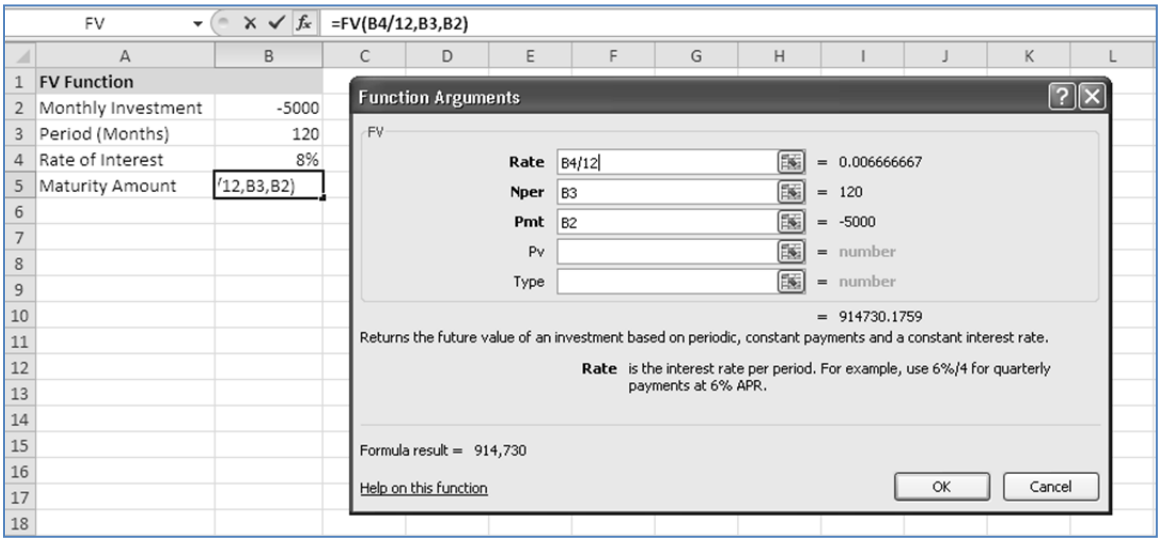


Fig 5.13.1: FV Function

Please Note:

(a) Period is given in months and rate of interest is given per anum. Here, while linking the rate interest, it should be divided by 12 to arrive at the monthly rate of interest.

(b) All outflows shall be considered as a negative figure as per excel norms. Hence monthly investment of ₹ 5,000 is written as negative figure.

Here the answer is appearing as ₹ 9,14,730.

Example 2:

Mr. Ashish Deshpande is planning to have ₹ 10.00 Lacs after five years for the purpose of education of his daughter. He wants to know how much he needs to invest every month considering a rate of interest of 8% p.a.

Solution

This question can be answered using two combination of two functions PMT and FV.

Look at the figure shown below. We have used PMT function and set the future value as ₹ 10.00 Lacs. The result shown is ₹ 13,610 as shown in Fig 5.13.2.

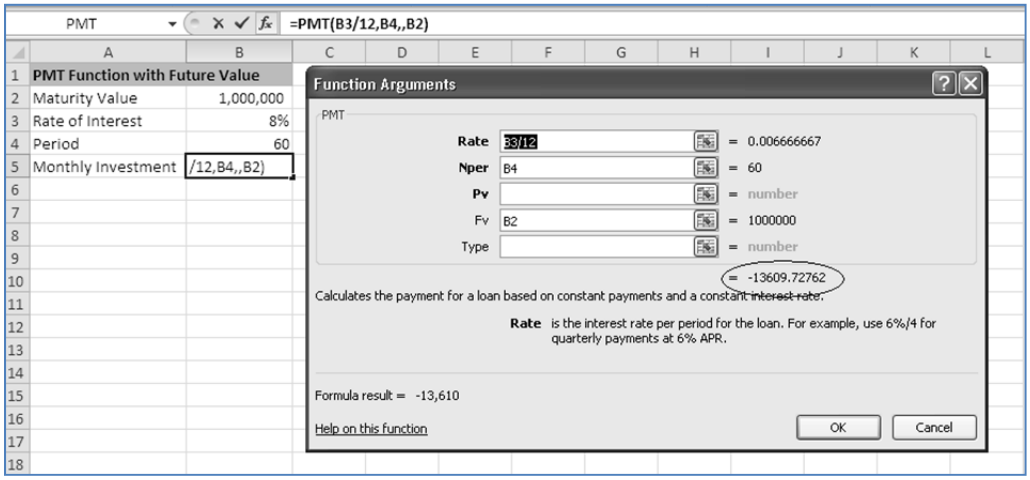


Fig 5.13.2: PMT Function with Future Value

Example 3:

Mr. Amit Shriwas want to have ₹ 5.00 lacs at the end of five years by investing ₹ 5,000 per month. He wants to know the rate of interest at which he should invest.

Solution:

This question can be answered using RATE function and future value.

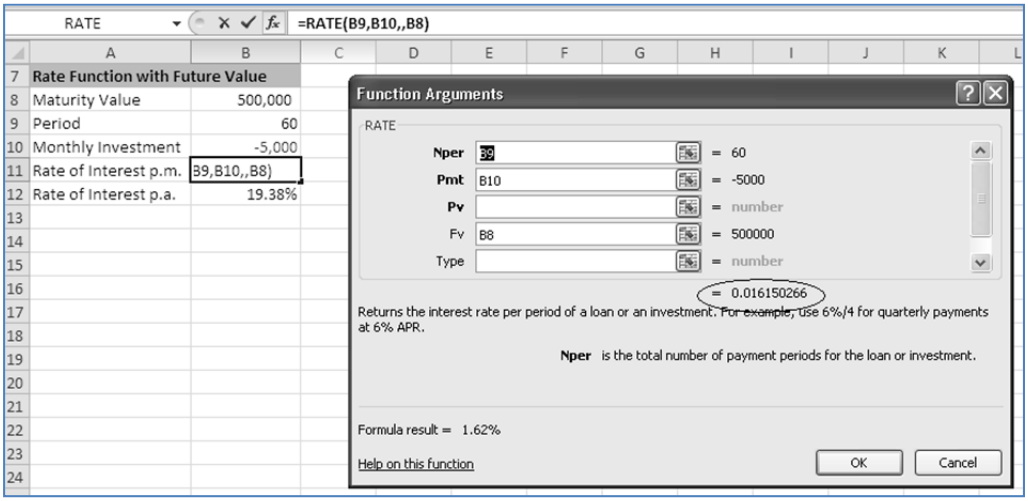


Fig 5.13.3: Rate Function with Future Value

As shown in the figure above, Mr. Amit Shriwas needs to invest ₹ 5,000 per month for 60 months @ 1.62% p.m., i.e. @ 19.38% p.a.

Example 4:

Ms. MayuraRahane is interest in investing ₹ 10,000 per month @ 10% p.a. She wants ₹ 5.00 Lacs for the purchase of a plot. She is interested in knowing the period for which she should invest to get ₹ 5.00 Lacs.

Solution:

This question can be answered using NPER function with future value as shown in Fig 5.1.3.4.

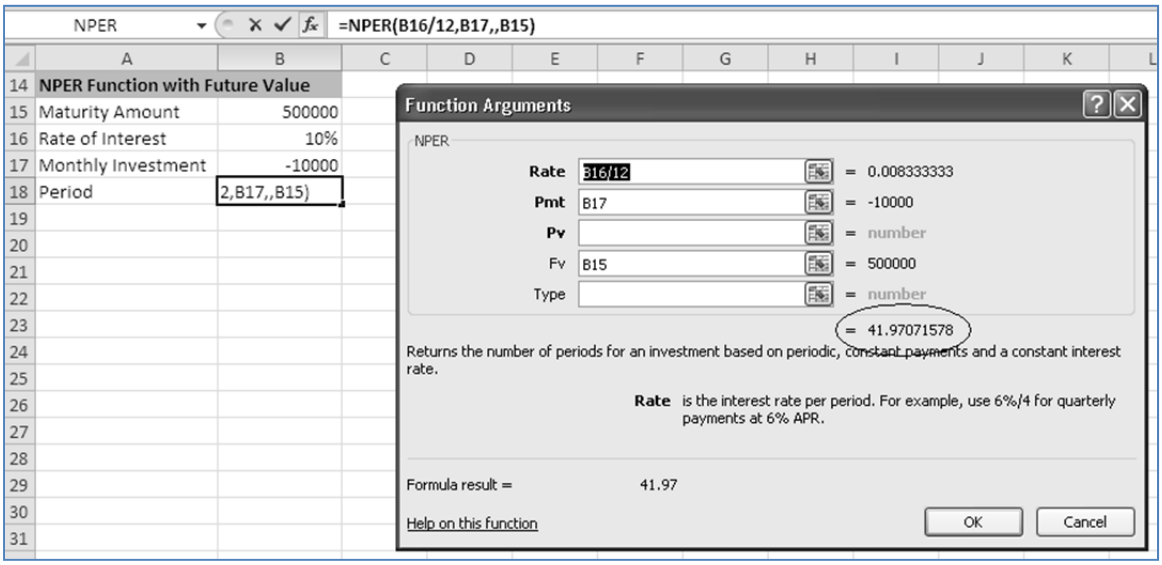


Fig 5.13.4: NPER Function

The answer is 41.97 Months.

5.14 Corporate Financial Planning

Basic rules of personal financial planning and corporate financial planning are same. The difference is in the quantum of money involved. As it is very high as compared to the money involved in personal financial planning, the amount of risk involved becomes very high. The amount of risk involved is also affected by the various other factors like changes in business conditions, technology, Government policies, international issues, etc.

Corporate planning can be defined as the process of setting the procedures in the organization for achieving the predefined goals. A corporate plan should incorporate the values and priorities of a company, with a comprehensive map of how to achieve those goals. The growth of a business depends on many factors like good leadership, a product or service in high demand etc but the most important is careful financial planning. The process of planning includes –

1. Research/ study of the existing situation.

2. Analysis about present resources and liabilities for an entity.
3. Goal Setting
4. Prioritisation of goals
5. Incorporate budget details into a feasible plan for the future.
6. Utilisation of existing resources for achievement of the goals.
7. Comparison of planned activities VS actual results at regular period of time.

Technological advancements play a vital role in financial planning at the corporate level. These advancements include usage of various software, comparison of periodical information, discussions among top management, passing of crystal clear goals before each and every individual, etc. Obviously excel can play an important role for corporate financial planning. Various formats can be prepared using functions / feature in excel. Following are some activities which are being carried out in the process of corporate financial planning.

1. Analysis of Financial Statements
2. Forecasting of Annual Revenues
3. Turning Points in Financial Trends
4. Forecasting Financial Statements
5. Forecasting seasonal revenues
6. Cash Budgeting
7. Calculation of NPV, IRR etc
8. Calculation of Cost of Capital
9. Calculations of Break Even Points, Profit and Leverage etc
10. Calculation Depreciation and taxes
11. Capital Budgeting and so on

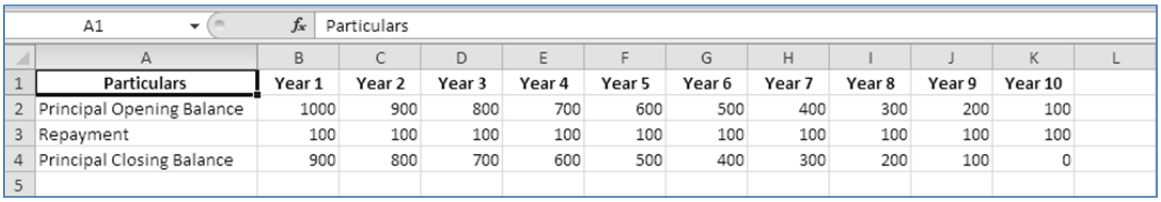
From above we get an overall idea what the corporate financial planning is and how it is being done.Many of the above stated features are explained earlier. Let us discuss some of the issues regarding financial planning and excel.

Example 1: Iterative Calculations

Indradhanu Consulting Pvt. Ltd. is planning to avail a term loan of ₹ 10.00 crores for a term of 10 years at 10% rate of interest p.a. For the purpose of preparation of financial plan for 10 years, they wish to calculate interest on average balance. Prepare a chart showing interest calculation and repayment.

Solution:

A simple chart can be prepared as shown in Fig 5.14.1(A).



	A	B	C	D	E	F	G	H	I	J	K	L
1	**Particulars**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**	
2	Principal Opening Balance	1000	900	800	700	600	500	400	300	200	100	
3	Repayment	100	100	100	100	100	100	100	100	100	100	
4	Principal Closing Balance	900	800	700	600	500	400	300	200	100	0	
5												

Fig 5.14.1(A): Iterative Calculations

In the above chart, we have calculated principal closing balance. This is not loan closing balance as interest payable is yet to be calculated. Please note that interest shall be calculated on average balance of loan and average balance shall be calculated as opening balance + closing balance divided by two.

The basic problem here is that we need to calculate interest for getting closing balance figure and at the same time closing balance figure is needed to calculate average balance, which is in turn used for calculation of interest. Hence, closing balance is needed for interest calculation and interest figure is needed for closing balance calculation. This question problem is just like "What Comes First ? Egg or Hen ? "

This problem can be solved by using Iterative Calculations in excel. Iterative calculation is a feature where calculation is performed in a loop automatically for required number of times. The result is displayed when the change in calculation is negligible.

Please note:

- In year 1, before considering the interest figure, average balance is (1000 + 900) /2 = 950
- Interest shall be calculated on this average balance @ 10%, i.e. 95.
- This 95 shall be added to the outstanding, closing balance shall increase to 995.
- Again the average balance shall be calculated considering the closing balance of 995.
- Now, the average balance shall be 997.50 and interest on this figure shall be 99.75.
- This process shall be repeated till the time the change between the two calculations is negligible.
- Calculating the interest to calculate average balance and vice versa is called as iterations.
- This can be done manually, as it is done in the sheet below. But it would take lot time.

	A	B	C	D	E	F	G	H	I	J	K
1	**Particulars**	**Year 1**	**Year 1**	**Year 1**	**Year 1**	**Year 1**	**Year 1**	**Year 1**	**Year 1**	**Year 1**	**Year 1**
2	Principal Opening Balance	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00
3	Repayment	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
4	Interest @ 10% on Average Balance		95.00	99.75	99.99	100.00	100.00	100.00	100.00	100.00	100.00
5	Principal Closing Balance	900.00	995.00	999.75	999.99	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00
6											
7	Average Balance	950.00	997.50	999.88	999.99	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00	1,000.00
8	Interest @ 10%	95.00	99.75	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00
9											

Fig 5.14.1(B): Iterative Calculations

In the above figure, all the calculations are for year 1 only. So ultimately we have settled on the interest figure of 100.00

Above type of iterative calculations can be very easily done using excel using following simple steps.

- Prepare a chart as shown above.
- Calculate the average balance.
- Calculate interest on average balance.
- Link this interest figure with Cell B4.
- As soon as you press ENTER to accept interest calculation, a Circular Reference Warning message is displayed. Excel assumes that something has gone wrong.
- Here, we need to tell excel that this is the way we wish to calculate interest and nothing has gone wrong. This can be done by making a small change as under.
- Click on File and go to Options.
- Go to Formulas.

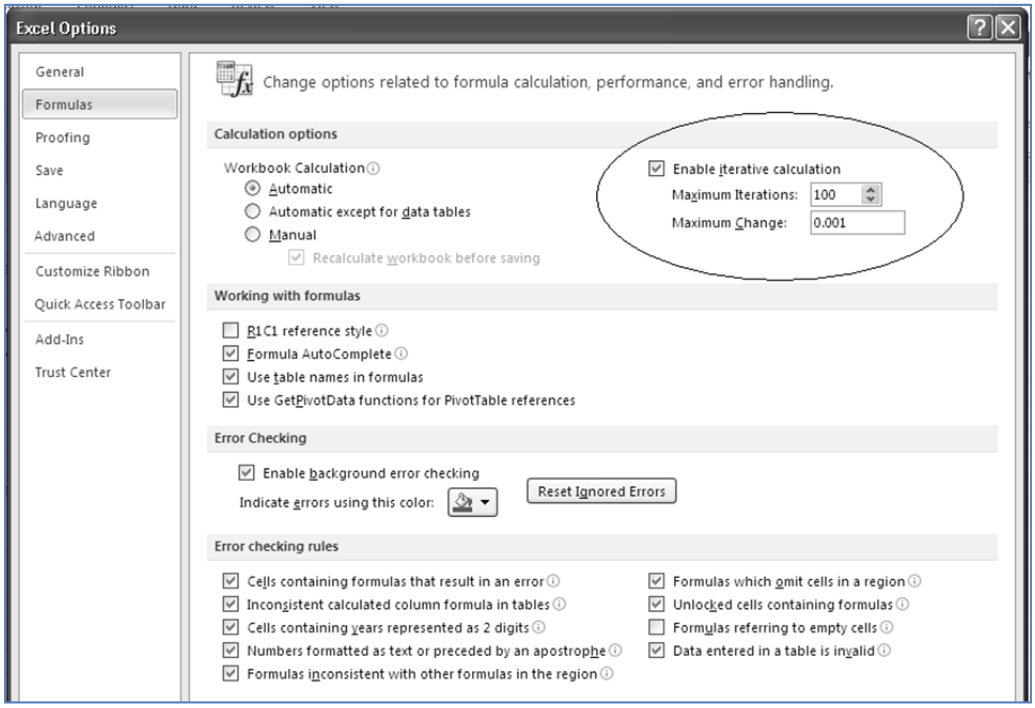


Fig 5.14.2: Excel Option

- Check the check box for “Enable iterative calculation”. Maximum iterations and maximum change figures can be specified here. Now onwards, excel shall not display any Circular Reference Warning Error Message.

- The completed chart shall look as shown in Fig 5.14.3.

B4 =AVERAGE(B2,B5)*0.1

	A	B	C	D	E	F	G	H	I	J	K
1	**Particulars**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**	**Year 7**	**Year 8**	**Year 9**	**Year 10**
2	Principal Opening Balance	1,000.00	900.00	800.00	700.00	600.00	500.00	400.00	300.00	200.00	100.00
3	Repayment	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
4	Interest @ 10% on Average Balance	100.00	89.47	78.95	68.42	57.89	47.37	36.84	26.32	15.79	5.26
5	Principal Closing Balance	1,000.00	889.47	778.95	668.42	557.89	447.37	336.84	226.32	115.79	5.26
6											

Fig 5.14.3: Complete Chart

In the above case, we have assumed that interest is paid separately.

Every single feature in excel can be used in variety of ways. Its use is limited by the imagination of the user only. The list of features and functions is just an illustrative list and not an exhaustive list.