Aim: In this lesson, you will learn:
To use spreadsheet to enter data.
Do simple calculations like sum, percentage and average on the given data.

Tejas: We visited a computer exhibition for school students. We saw a super computer, demonstration of many uses of computer and many more interesting applications.

Jyoti: In one of the stalls, we could enter any number as input and the computer was displaying the multiplication table of the number. (Shown above) This picture used by the person at the stall, to explain the sequence of steps followed by the computer, to display the table.

Jyoti: We observed that those who did not know about computers and programming could also understand what was explained by the picture.

Moz: This picture is a graphical representation called a flowchart. One of the main uses of a flowchart is to write the sequence of steps and logic of solving a problem, before writing the full computer program. It also helps in communicating the steps of the solution to others.

What is a flow chart?

- A flowchart is a graphical representation of the problem solving process.
Tejas: I see that various geometrical shapes are used in this representation. We are eager to learn about flowcharts.

Moz: Let us start with a simple example. Look at the following flowchart of adding two natural numbers A and B. Let us discuss the problem solution and the geometrical shapes used.

Moz: What do you do when you are given a problem?
Tejas: First we identify the goal. Here it is addition of two given numbers.

Moz: How do you achieve this goal?
Jyoti: First we identify the data that is given. In this problem we have the two numbers A and B. Reading their values represented by parallelograms.
Moz: Right. What would you call this in computer terms?
Jyoti: Input.

Moz: The data or information that is available, (which is called input) is represented using a parallelogram in the flowchart.

Moz: What is the next step?
Tejas: The next step is to add the numbers, which is called processing in computers. We learned this term in “Inside computer” lesson.

Moz: Correct. The details of processing of data is represented in a rectangle.
Jyoti: The next step is to write the result of the addition which is output in computer terms. This is also specified in a parallelogram.

Moz: Right. A parallelogram is used to specify both input and output in a flowchart. What else do you notice in the flowchart?

Tejas: An arrow points from one step to the next step in the flowchart.

Moz: In a flowchart arrows are used not only to connect the steps in a sequence but also to show a clear flow of the problem solving process.

Jyoti: Start and also end of the flowchart are shown with an ellipse.

Moz: A flowchart should give a clear indication as to where the problem solving flow starts and where it ends. The start of a problem solving process and the end are indicated using the ellipse.

Jyoti: This is just like using ‘step-wise thinking’ lesson step by step to solve a problem.

Moz: Yes. The step by step method of solving the problem is specified using a flowchart. This helps you to be clear about the input, procedure and output. It also helps you to communicate the solution.

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**Uses of flowchart**

- To specify the method of solving a problem.
- To plan the sequence of a computer program.
- Communicate ideas, solutions.

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**Drawing of a flowchart**

- Follow step-by-step thinking and logical reasoning of solving a problem.
- Identify the goal or the solution to be found.
- Think of the sequence of steps for working out the solution to the problem.
  - Identify start, input, process, output and end.
- Use appropriate symbol to represent each step in the sequence.
- Use directional arrows to show the flow of the sequence of steps.
- Check that the flow of the solution is clearly communicated through the flowchart.

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Moz: Now consider the following problem and draw the flowchart for its solution.

Savani bought a toy for Rs. 325 and sold the same for Rs. 458. Explain how we can find if Savani has made a profit or a loss.

Tejas: In this problem the goal is to find whether Savani makes a profit or loss.

Jyoti: We know the Cost Price and the Selling Price. We can read them as input, so they are represented as parallelograms.

Tejas: Next we have to compare Selling Price and Cost Price to find which price is more. This will tell us whether Savani has made profit or loss. How do we show comparison in a flowchart?
Moz: Can you phrase this step as a question with the two possible answers?
Tejas: We can ask a question “Is selling price more than cost price?”. The answer to this question can be “Yes” or “No”. If, answer is “Yes” we have to calculate profit and if, answer is “no” we have to calculate loss.
Moz: Right. In this step you have two alternate actions that can be taken. The decision of which action has to be taken is decided by the answer to the question. The answer can be “Yes” or “No”. This decision taking step is represented as follows in a flowchart.

Jyoti: If the answer is “Yes”, it means that selling price is more than the cost price and Savani has made profit. Profit is calculated as,
Selling price – cost price
If the answer is “No” it means that cost price is less than selling price and Savani has made loss. Loss is calculated as
Cost price – Selling price.
Moz: Good. You have used logical reasoning to solve this problem. Now draw the flowchart.

Flowchart - How to find profit or loss.
For given example

1. Read
   CP=325
   SP= 458
2. Condition
   SP is grater than CP
3. Processing
   Profit= 458-325
   = 133
4. Output
   Savani made profit of
   Rs. 133
Moz: Suppose you have to write a scratch program for the above. Can you do it now?
Tejas: Yes. We can!
Jyoti: This is great. We can also plan a computer program using flowcharts.
Jyoti: Sometimes we need to repeat a sequence. How do we represent this in the flowchart?
Moz: Let us consider the multiplication table flowchart that you saw at the exhibition. See how repetition is represented in a flowchart.

**Flowchart of multiplication table for a given number N**

**Multiplication table of 12 upto 10**

Start
N = 12
Count =1
12 * 1 = 12
Count = 1+1 = 2
12 * 2 = 24
Count = 2+1 = 3

Count = 9+1 = 10
12 * 10 = 120
Count =10
End

**Flowchart symbols and their purpose**

<table>
<thead>
<tr>
<th>Geometric shape</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ellipse</td>
<td>Start, End, Stop, Exit. (Stop or End or Exit – these all mean End).</td>
</tr>
<tr>
<td>Parallelogram</td>
<td>Data, Input, output.</td>
</tr>
<tr>
<td>Rectangle</td>
<td>Action, activity, process.</td>
</tr>
<tr>
<td>Diamond</td>
<td>Decision making step. Specify the question in the diamond. The next logical step is based on the answer “Yes” or “No” to the question.</td>
</tr>
<tr>
<td>Arrows</td>
<td>Arrows are used to connect the steps in a flowchart, to show the flow or sequence of the problem solving process.</td>
</tr>
</tbody>
</table>
Tejas: The repetition sequence stops when count = 10. So here a decision structure has been used to start and stop the repetition.

Moz: Try out another problem to see how you can use such an assignment.
Tejas: Let us draw a flowchart to find the factorial of a number.
Moz: How do you find the factorial of a number?
Jyoti: Suppose the number is 10. Then factorial of ten is calculated as
10! = 1*2*3*4*5*6*7*8*9*10

Moz: Good. Draw the flowchart.

**Find factorial of N**

```
Start
N = 10
M = 1
F = 1
F = 1 * 1 = 1; M<10; M = 1 +1 = 2
F = 1 * 2 = 2; M<10; M = 2 +1 = 3
F = 2 * 3 = 6; M<10; M = 3 + 1= 4
F = 6 * 4 = 24; M<10; M = 4 +1 = 5
M<10; M = 9 + 1 = 10
F = 362880 * 10 = 3628800
M = N = 10
Factorial of 10 = 3628800
End
```
Moz: Good. From the examples that you have seen, can you summarize what are all the basic structures of representation?

Tejas: In the addition of numbers example, we saw how to show a sequence of processing steps.

Jyoti: In the finding profit and loss example, we saw how alternate sequences can be specified using a decision box.

Tejas: In the multiplication table and factorial examples, we saw how to show repetition of a sequence.

Jyoti: Flowcharts can be drawn for a problem solving process using these three basic structures.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sequence</td>
<td>Sequence of steps are represented by symbols that follow each other top to bottom or left to right.</td>
</tr>
<tr>
<td>Selection</td>
<td>A condition or a question is specified in the Decision box. Based on the evaluation of the condition one of the logical steps is taken next. The next logical step can be a process, decision, or end of the flowchart.</td>
</tr>
<tr>
<td>Repetition</td>
<td>Either the processing repeats or the control leaves the structure.</td>
</tr>
</tbody>
</table>

Moz: Good. Now let us consider a game. Do you know the game of snakes and ladders?

Tejas: Yes.

Moz: Ok. Draw a flowchart to show how the game is played.
Flowchart - Snakes and Ladder game

Start

Throw the dice

Move your coin

Landed on Snake head? Yes → Slide down to the tail of the snake

Landed at the bottom of the ladder? Yes → Move up the ladder

Reached the last Block of the game? No → Give dice to next player

You are the Winner

End
Tejas: The flowchart itself can be put into the box of the game so that those who want to play know the rules of the game and can easily understand how they win.

Moz: We have seen some examples where flowcharts are used. There are many more uses of flowcharts and they can be used whenever you feel that you can communicate better with this graphical representation.

Other uses of flowchart

- Classification of....
- To teach and also to learn.
- Communicating ideas

Tejas: We are eager to learn another programming language.

Moz: Sure. Next you will be learning BASIC where you can use some of the flowcharts that you have drawn in this lesson. Chin Chinaki...

Lesson Outcome

At the end of the lesson, you will be able to:
- Write an outline for a given topic.
- Create a presentation.
- Check content for consistency (font, grammar, spellings) and use design options.
- Follow guidelines for creating presentations.