

Introduction to Problem Solving

Reference:

Problem Solving and Programming Concepts 9th Edition

by [Maureen Sprankle](#) and [Jim Hubbard](#)

Outlines

- General Problem Solving
- Six Steps of Problem Solving
- Structure of Programs
- Beginning Computer Concepts for Problem Solving
- Problem Solving Organization Tools

General Problem Solving

- People make decisions every day to solve problems that affect their lives
 - Important problems
 - Unimportant problem
- Bad/Good decision

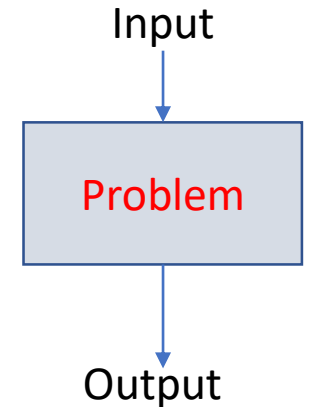
Six Steps of Problem Solving

- There are six steps to follow to ensure the best decision.
- Most people use them without even knowing it:
 1. Identify the problem.
 2. Understand the problem.
 3. Identify alternative ways to solve the problem.
 4. Select the best way to solve the problem from the list of alternative solutions.
 5. List instructions that enable you to solve the problem using the selected solution.
 6. Evaluate the solution.

Six Steps of Problem Solving

1. Identify the problem

- The first step toward solving a problem is to identify the problem
- **What is the specific problem?**
 - This means you should determine what is that you want to change.
- **Clearly define the goal that you want to achieve.**
 - What are you trying to achieve?
- **Determine what are the inputs and outputs**
- If you don't know what the problem is, you cannot solve it.



Six Steps of Problem Solving

2. Understand the problem

- You must understand what is involved in the problem before you can continue toward the solution.
- This includes understanding the **knowledge base of the person or machine** for whom you are solving the problem.
- Also, you must know your own knowledge base., You cannot solve a problem if you do not know the subject. For example, to solve a problem involving accounting, you must know accounting.

Six Steps of Problem Solving

3. Identify alternative ways to solve the problem

- Generate as many potential solutions as possible.
- List the features for each possible solution

Six Steps of Problem Solving

4. Select the best way to solve the problem from the list of alternative solutions

- In this step, you need to identify and evaluate the pros and cons of each possible solution before selecting the best one
- In order to do this, you need to select criteria for the evaluation

Six Steps of Problem Solving

5. List instructions that enable you to solve the problem using the selected solution

- Create a numbered, step-by-step instructions that must fall within the knowledge base set up in step 2

Six Steps of Problem Solving

6. Evaluate the solution

- To evaluate or test a solution means to check its result to see if it is correct, and to see if it satisfies the needs of the person(s) with the problem.
- Test the solution
 - Are the results accurate?
 - Does the solution solve the original problem?
 - Does it satisfy the needs of the user?
 - Is it acceptable to the user?

Problem Solving Example

Problem description	Steps	Outcome.
Today is the final day for Abeer in high school, she & her family gathered to decide which university for here to attend.	Identify the problem.	Problem: Enrolling in a university & department Goal: Name university and department that she will this year.
	Understand the problem.	Facts: <ul style="list-style-type: none"> Searching for Universities available. Knowing her grades, hobbies, specialties and Gender.
	list possible solutions to the problem	<ul style="list-style-type: none"> go local university.(speed, not have desired section, monthly reward) go a broad.(trip expenses, have desired section, free enrolment, monthly reward) go private university.(trip expenses very expensive , school I prefer, enrolment is not free)
	Select the best solutions to the problem.	Criteria: <ol style="list-style-type: none"> enters high ranked university and desired section. Not expensive. Free. So, solution 2.
	List instructions (Do Stage)	<ol style="list-style-type: none"> Send an enrol application to the university. Wait for reply. Pack your stuff, go to university. Attend first day.
	Evaluate the solution (Review and Revise).	I felt lonely, grades were low. So, must change solution(revaluate)

Structure of Programs

- Use modules to break the whole problem into parts, with each part having a particular function.
- Use the three logic structures to ensure that the solution flows smoothly from one instruction to the next, rather jumping from one point in the solution to another.

Structure of Programs

- Program Structures:

- The sequential Structure.

- Ex: Simple calculation.

- The Decision Structure.

- Ex: Decide if student pass or fail.

- The Loop Structure.

- Ex: Repeat displaying a warning message 10 times.

Beginning Computer Concepts for Problem Solving

- There are 3 types of problem that can be solved in computer:
- **Computational problems**
 - involving some kind of mathematical processing
- **Logical Problems**
 - involving relational or logical processing
- **Repetitive Problems**
 - involving repeating a set of mathematical and/or logical instructions.

Beginning Computer Concepts for Problem Solving

- Basic building programming blocks:
 - Equations
 - Consist of constant, variables and operators.
 - Expressions
 - Decisions and repeat control statements.
 - Functions

Beginning Computer Concepts for Problem Solving

- Constants:
 - Does not change during the processing of all the instructions in a solution
 - Can be of any data type: numeric, alphabetical or special symbols
 - Examples
 - 3, 5, 10, "Sara", "+", "-", "/"

Beginning Computer Concepts for Problem Solving

- Variables:
 - May change during processing
 - In many programming languages, variables are called **identifiers**.
 - A name is assigned to each variable used in a solution and should be consistent with what the value of the variable represents.
 - The computer uses the variable name to find the location; it uses the value found at the memory location to do the processing.
- Ex:
 - Name="Java"
 - Test_Score=95

Beginning Computer Concepts for Problem Solving

- Data Types:
 - Data can come with different type:
 - Numeric
 - Character
 - Logical
 - Computer should know the data type of each variable or constant .

Beginning Computer Concepts for Problem Solving

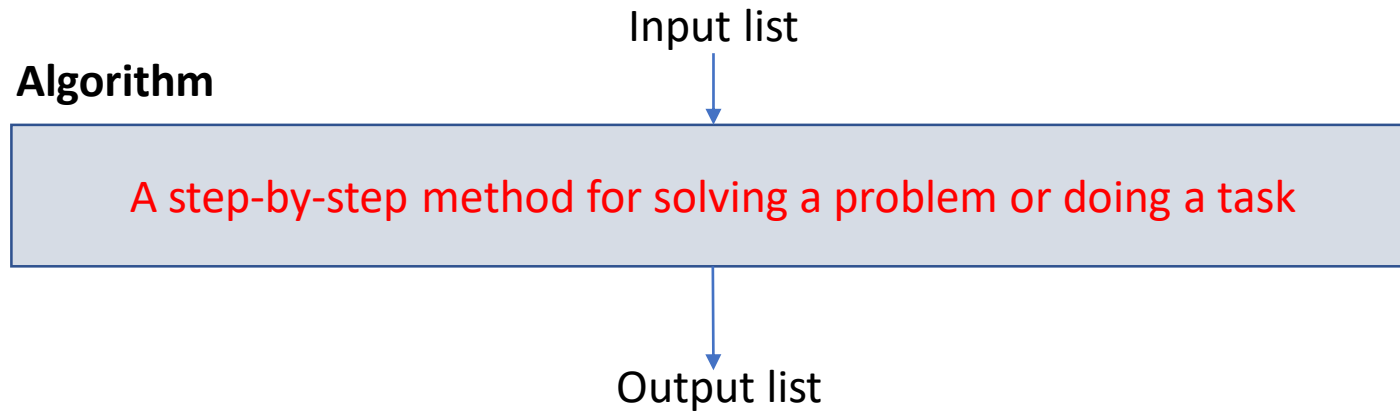
Data Type	Data Set	Examples
Numeric :Integer	All whole numbers	3456 -43
Numeric :Real	All real numbers (whole + decimal)	3456.78 0.000123
Character (uses quotation marks)	All letters, numbers, and special symbols	"A", "a", "1", "5", "+", "%"
String (uses quotation marks)	Combinations of more than one character	"Mulder" "Scully" "123-45-6789"
Logical	True or False	True False

Solution Organization Tools

- Certain organizational tools will help you learn to how solve problems on the computer.
- The tools include the:
 - Pseudocode Algorithm
 - Flowchart

Algorithm

- The next step of organizing a solution is to develop sets of instructions for the computer, called algorithms.



Writing the Algorithm

- The next step of organizing a solution is to develop sets of instructions for the computer, called algorithms.

The Form of an Algorithm

Name of Module

1. *Instruction*

2. *Instruction*

3. ..

4. ..

..

—, exit

Writing the Algorithm

- The programmer writes a separate set of instructions for each program or (module).
- The number of instruction is determined by the way the programmer chooses to solve the problem.


Drawing the Flowchart

- Flowchart is a graphic representations of the algorithms.
- The algorithms and flowcharts are the **final steps** in organizing a solution.
- A flowcharts shows **the flow of the processing** from the beginning to the end of a solution.

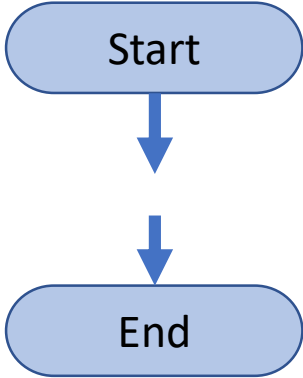
Drawing the Flowchart

- Each block in a flowchart represents **one instruction** from an algorithm.
- Flowlines indicate the **direction** of the data flow.
- Most block have one or more entrances and have only one exit .


Flowchart Symbol

Flowchart Symbol	Explanation
 <p data-bbox="389 661 550 699">Flowline</p>	<ul style="list-style-type: none"><li data-bbox="774 611 2323 782">• Flowlines are indicated by straight lines with arrows to show the direction of data flow.<li data-bbox="774 862 2262 1033">• Flowlines are used to connect blocks by exiting from one and entering another.


Flowchart Symbol

Flowchart Symbol	Explanation
 <pre>graph TD; Start([Start]) --> End([End]);</pre>	<ul style="list-style-type: none">• Flattened ellipses indicate the start and the end of a module. An ellipse uses the name of the program (module) at the start.• The end is indicated by the word <i>end</i> or <i>stop</i>.• A start has no flowlines entering it and only one exiting it; an end has one flowline entering it but none exiting it.

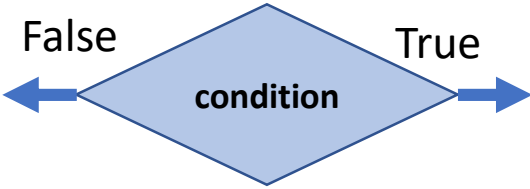
Flowchart Symbol

Flowchart Symbol	Explanation
 <p data-bbox="366 611 580 654">Processing</p>	<ul style="list-style-type: none"><li data-bbox="764 554 2280 763">• The rectangle indicates a processing block, for such things as calculations,<li data-bbox="764 868 2288 1078">• opening and closing files, and so forth. A processing block has one entrance and one exit.

Flowchart Symbol

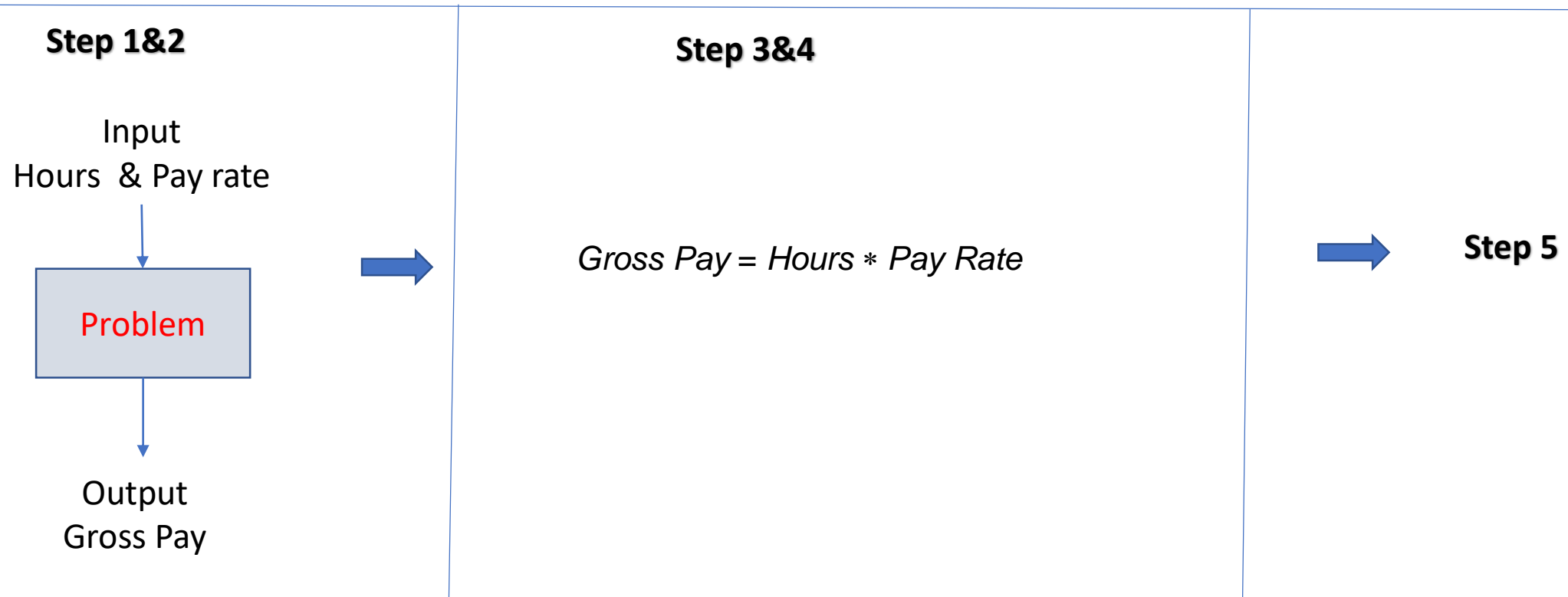
Flowchart Symbol	Explanation
 <p data-bbox="257 601 624 646">Input/Output (I/O)</p>	<ul style="list-style-type: none"><li data-bbox="766 532 2142 711">• The parallelogram indicates input to and output from the computer memory.<li data-bbox="766 786 2295 839">• An input/output (I/O) block has one entrance and only one exit.

Flowchart Symbol

Flowchart Symbol	Explanation
 <p>Decision</p>	<ul style="list-style-type: none">• The diamond indicates a decision. It has one entrance and two and only two exits from the block.• One exit is the action when the resultant is <i>True</i>, and the other exit is the action when the resultant is <i>False</i>.

Example: Payroll System

- **Problem:** Calculate the gross pay of an employee given the hours worked and the rate of pay. The gross pay is calculated by multiplying the hours worked by the rate of pay.



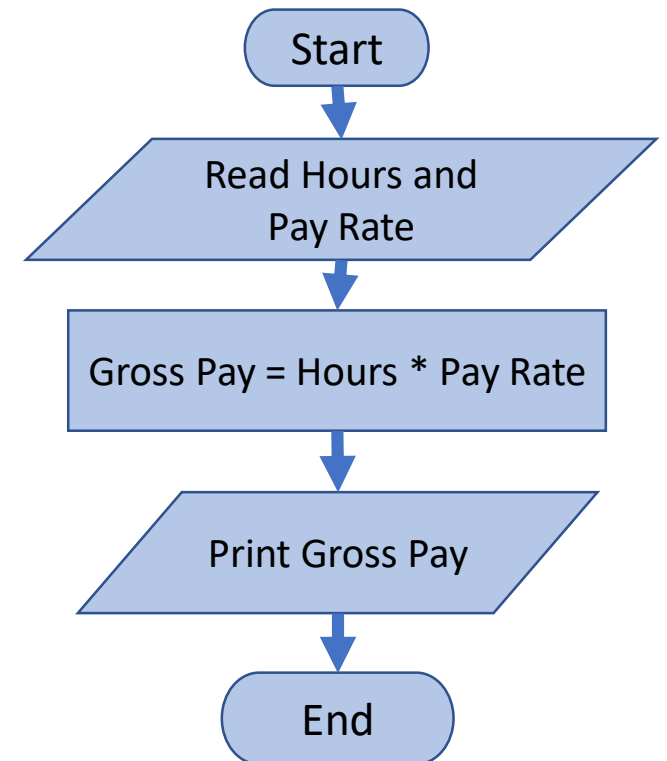
Example: Payroll System

- **Problem:** Calculate the gross pay of an employee given the hours worked and the rate of pay. The gross pay is calculated by multiplying the hours worked by the rate of pay.

Step 5

Gross Pay Calculation

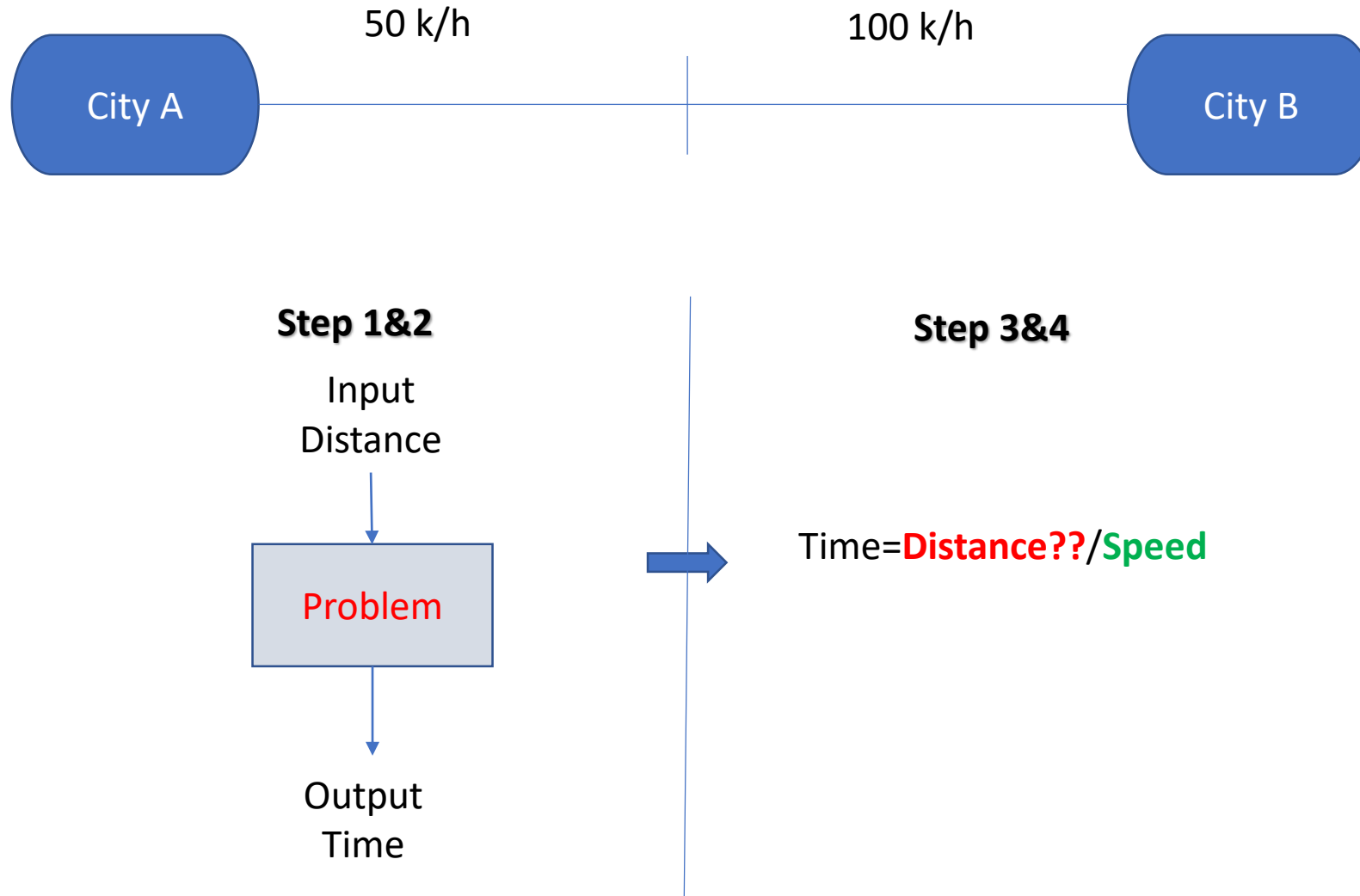
1. Enter Hours Worked
2. Enter Pay Rate
3. Calculate Pay
4. Print Pay
5. End



Develop a flowchart

- Sarah is traveling from city A to city B. The distance between the two cities is a variable because she would like to use the equation to use for other cities. She knows that 50% of the time she will be traveling 50 kilometre an hour and the remaining 50% she will be traveling 100 kilometre per hour. Write an equation that will calculate the time it will take to travel from one city to the next.

Solution



Solution

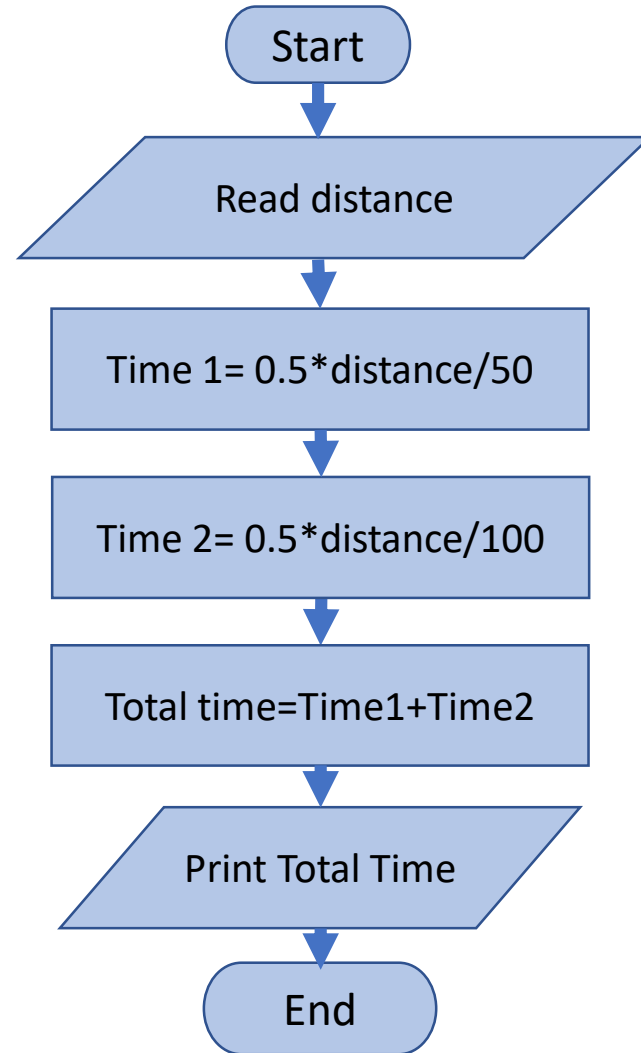
Step 5

Travelling Time Calculation

1. Enter travelling distance
2. Calculate required time for first half distance
3. Calculate required time for second half distance
4. Total time=Time 1+Time 2
5. Print Total Time
6. End

Solution

Step 5



Develop a flowchart & algorithm

- Ahmad would like to know the average of his test scores. Write an equation that would calculate the average given five test scores.

A solid orange rectangular box with a thin blue border, containing the text "Give student 5 min to solve".

Give student 5 min to solve

Solution

Step 5

Travelling Time Calculation

1. Enter the five test grades
2. Calculate total grades
3. Calculate average of grades
4. Print average
5. End

Solution

Step 5

