G.C.E. O/L Grade 11 ICT · Lesson 1

1.1 Problem Analysis: Inputs, Process and Outputs

Syllabus 10.1. Before we write a program, we must understand the problem. A **program** is a set of instructions that tells a computer what to do, step by step. In this note you will learn to find the **inputs**, the **outputs** and the **process** of a problem, to think of **different ways** to solve it, and to choose the **best** one. This is called **problem analysis**.

1. What is programming?

A computer cannot think by itself. It only follows instructions. Writing those instructions in a language the computer understands is called **programming**, and the person who writes them is a **programmer**. A program can be small (adding two numbers) or very big (the Sri Lanka Railways e-ticket system, a bank ATM or a mobile game).

> 💡 Think of a recipe for kiribath. The rice, coconut milk and salt are the **inputs**; cooking is the **process**; the plate of kiribath is the **output**. A program works the same way.

2. Steps of problem solving

Understand the problem
ගැටලුව තේරුම් ගන්න

Find inputs and outputs
ආදාන සහ ප්‍රතිදාන සොයන්න

Plan the process
ක්‍රියාවලිය සැලසුම් කරන්න

Choose the best solution
හොඳම විසඳුම තෝරන්න

Write and test the program
වැඩසටහන ලියා පරීක්ෂා කරන්න

3. Inputs, process and outputs (IPO)

Input – data given to the program (typed, scanned, read from a sensor). **Process** – the work done on the data (calculate, compare, sort). **Output** – the result given back (shown on screen, printed, sent as an SMS). We often write them in an **IPO table**.

Problem	Input	Process	Output
Shop bill	Price, quantity	Total = Price × Quantity	Total
Average of 3 marks	Mark1, Mark2, Mark3	Add, then divide by 3	Average
Electricity bill (CEB)	Units used	Units × rate + fixed charge	Amount to pay
Pass or fail	Mark	Is mark ≥ 35?	“Pass” or “Fail”

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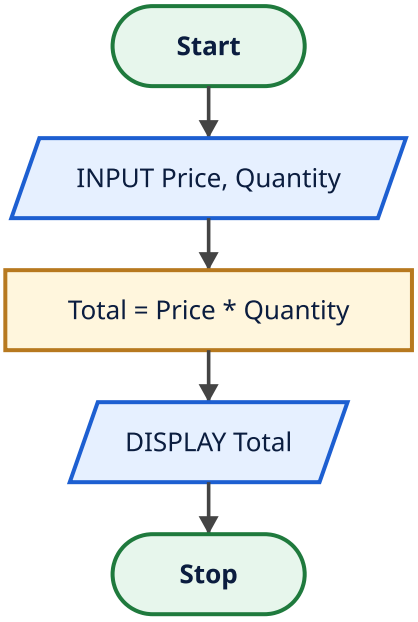
Bus ticket (Colombo–Kandy)	Number of passengers	Passengers × fare	Total fare

4. A worked example: the shop bill

Problem: A shop sells soap at Rs. 150 each. Find the total for any number of soaps. **Input:** price, quantity. **Process:** total = price × quantity. **Output:** total. Below is the same solution as pseudocode, as a flowchart and as a real program. Don't worry about the code yet – you will learn it step by step in 1.3 to 1.10.

Pseudocode

```
BEGIN
  INPUT Price, Quantity
  Total = Price * Quantity
  DISPLAY Total
END
```



Flowchart – Shop bill: price × quantity

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Shop bill: price × quantity

Pascal

```
program ShopBill;
var
  price, qty, total: integer;
begin
  write('Enter price (Rs.): ');
  readln(price);
  write('Enter quantity: ');
  readln(qty);
  total := price * qty;
  writeln('Total = Rs. ', total);
end.
```

Python

```
price = int(input("Enter price (Rs.): "))
qty = int(input("Enter quantity: "))
total = price * qty
print("Total = Rs.", total)
```

Sample run

```
Enter price (Rs.): 150
Enter quantity: 5
Total = Rs. 750
```

5. Alternative solutions (the solution space)

Most problems can be solved in **more than one way**. All the possible ways together are called the **solution space**. Example: find the sum of the numbers 1 to 100. **Method 1:** add them one by one with a loop (100 additions). **Method 2:** use the formula N × (N + 1) ÷ 2 (one multiplication and one division). Both give **5050**, but Method 2 is much faster.

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Method 1: add the numbers one by one

Pascal

```
program SumLoop;
var
  i, total: integer;
begin
  total := 0;
  for i := 1 to 100 do
    total := total + i;
  writeln('Sum = ', total);
end.
```

Python

```
total = 0
for i in range(1, 101):
    total = total + i
print("Sum =", total)
```

Sample run

```
Sum = 5050
```

Method 2: use the formula N × (N + 1) ÷ 2

Pascal

```
program SumFormula;
var
  n, total: integer;
begin
  n := 100;
  total := n * (n + 1) div 2;
  writeln('Sum = ', total);
end.
```

Python

```
n = 100
total = n * (n + 1) // 2
print("Sum =", total)
```

Sample run

```
Sum = 5050
```

Compare	Method 1 (loop)	Method 2 (formula)
Number of steps for N = 100	About 100 additions	2 operations
Easy to understand?	Yes	Yes, if you know the formula
Speed for N = 1 000 000	Slower	Very fast
Result	5050	5050

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6. How to choose the best solution

- **Correct** – gives the right answer for every valid input.
- **Efficient** – fewer steps, less time and memory.
- **Simple** – easy to read, test and change later.
- **Cost and resources** – uses the hardware and software we have.

> NEW 2026 2026: You can practise programming free on a school computer or even a phone. Python and Pascal both run in **online compilers** (for example OnlineGDB or Programiz) – no installation needed. The programs on these pages were all really run, and the sample outputs are copied from the real results.

Key Words

Program – A set of instructions a computer follows step by step.	**Programming** – Writing instructions for a computer in a programming language.
Programmer – A person who writes programs.	**Problem analysis** – Studying a problem to find its inputs, process and outputs.
Input – Data given to a program.	**Process** – The work done to change inputs into outputs.
Output – The result a program gives.	**IPO table** – A table listing the inputs, process and outputs of a problem.
Solution space – All the possible ways to solve a problem.	**Alternative solution** – A different way of solving the same problem.
Efficient – Uses fewer steps, less time and less memory.	**Online compiler** – A website where you can type and run a program without installing anything.

Sample Q&A

1. What is a program?

> **Answer:** A set of instructions that tells a computer what to do, step by step.

2. Name the three parts we find in problem analysis.

> **Answer:** Input, process and output.

3. Give the inputs and output of a program that finds the area of a rectangle.

> **Answer:** Inputs: length and width. Output: area (process: area = length × width).

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4. What is the solution space?

> **Answer:** The set of all possible ways to solve a problem.

5. Give two ways to find the sum of 1 to 100 and say which is better.

> **Answer:** Add one by one with a loop, or use N × (N + 1) ÷ 2. The formula is better – far fewer steps.

6. List three things to check when choosing the best solution.

> **Answer:** It is correct, efficient (fast, little memory) and simple to read and change.

MCQ

1. A set of instructions that a computer follows is called a...

A. program
B. network
C. database table
D. monitor

2. In a shop bill program, the quantity bought is...

A. an output
B. a printer
C. an input
D. a process

3. In the same program, the total amount shown on the screen is...

A. an input
B. a variable name only
C. an output
D. a reserved word

4. "Total = Price × Quantity" is part of the...

A. process
B. output
C. hardware
D. input

5. The first step of problem solving is to...

A. buy a computer
B. understand the problem
C. type the program
D. print the output

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6. For a program that finds the average of three marks, the inputs are…

A. the average
B. the printer
C. the number 3 only
D. the three marks

7. All the possible ways of solving a problem are together called the…

A. output space
B. input device
C. solution space
D. memory space

8. Using N × (N + 1) ÷ 2, the sum of 1 to 100 is…

A. 10100
B. 5050
C. 100
D. 5000

9. Why is the formula method better than adding 1 to 100 one by one?

A. It needs far fewer steps
B. It gives a different answer
C. It uses more memory
D. It needs a printer

10. A good solution should be…

A. long and complex
B. impossible to change
C. correct, efficient and simple
D. correct only for one input

11. In a CEB electricity bill program, the number of units used is…

A. an output
B. the solution space
C. a constant output
D. an input

12. Which is an output device that can show a program’s result?

A. Monitor
B. Keyboard
C. Mouse
D. Scanner

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13. The table that lists inputs, process and outputs is the…

A. truth table
B. IPO table
C. trace table only
D. periodic table

14. For price 150 and quantity 5, the shop bill program shows…

A. Total = Rs. 155
B. Total = Rs. 145
C. Total = Rs. 30
D. Total = Rs. 750

15. You can run a Python or Pascal program without installing anything by using…

A. a spreadsheet chart
B. an online compiler
C. a word processor
D. a scanner

Structured Questions

1. (i) What is problem analysis? (1 mark)
(ii) Draw an IPO table for a program that finds the area of a rectangle. (3 marks) *(4 marks)*

> (i) Studying a problem to find its inputs, process and outputs before writing the program. (ii) Input: length, width (1); Process: area = length × width (1); Output: area (1).

2. A bus from Colombo to Kandy charges the same fare for every passenger. Identify the inputs, process and output of a program that finds the total fare. (3 marks) *(3 marks)*

> Inputs: number of passengers and fare (1); process: total = passengers × fare (1); output: total fare (1).

3. Give two different methods to find the sum of the numbers 1 to N. Which is more efficient? Why? (4 marks) *(4 marks)*

> Method 1: add 1, 2, 3 … N one by one with a loop (1). Method 2: use N × (N + 1) ÷ 2 (1). Method 2 is more efficient (1) because it uses only two operations whatever N is, while the loop needs N additions (1).

4. List the five steps of solving a problem with a computer, in order. (5 marks) *(5 marks)*

> 1 Understand the problem; 2 find inputs and outputs; 3 plan the process (algorithm); 4 choose the best solution; 5 write and test the program (1 each).

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5. Give three things you should check when choosing the best solution from the solution space. (3 marks) *(3 marks)*

> Correct for all valid inputs; efficient (fewer steps, less time/memory); simple to read, test and change; suits the available resources (any three).

Summary

- Program = set of instructions for a computer.
- Problem analysis comes before writing code.
- Input = data in; output = result out.
- Process = work that changes inputs into outputs.
- Use an IPO table to plan.
- Solution space = all possible solutions.
- Best solution: correct, efficient, simple.
- Sum 1–100: loop or formula; both give 5050.

MCQ answer key – 1.1

1. **A** – A program is a set of instructions.
2. **C** – It is data given to the program.
3. **C** – It is the result.
4. **A** – Calculation = process.
5. **B** – Understand first.
6. **D** – Marks are given; average is the output.
7. **C** – Solution space.
8. **B** – 100 × 101 ÷ 2 = 5050.
9. **A** – Same answer, fewer steps.
10. **C** – Correct, efficient, simple.
11. **D** – Units are read from the meter and given to the program.
12. **A** – Monitor shows output.
13. **B** – IPO = Input-Process-Output.
14. **D** – 150 × 5 = 750.
15. **B** – Online compilers run code in the browser.

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