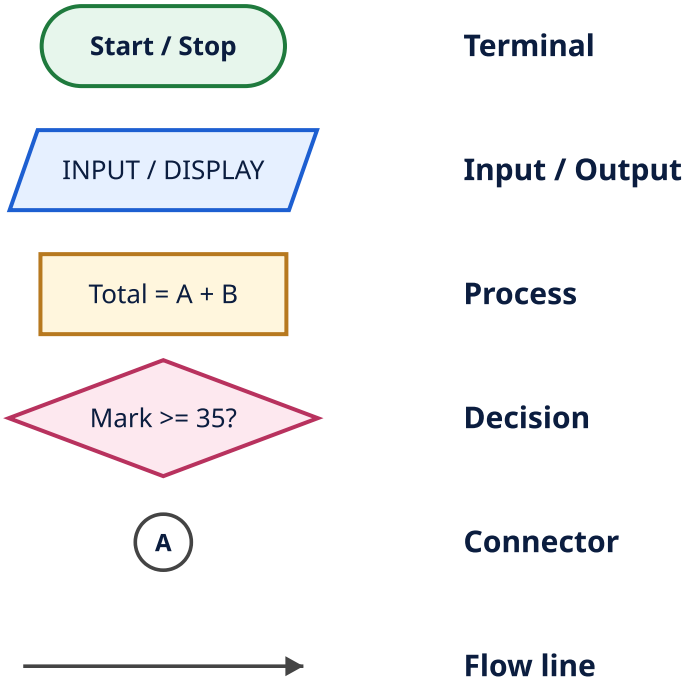
G.C.E. O/L Grade 11 ICT · Lesson 1

1.3 Flowcharts and Pseudocode

Syllabus 10.3. We show an algorithm in two main ways. A **flowchart** is a **picture** made of standard symbols joined by arrows. **Pseudocode** is the algorithm written in **short English-like lines**, close to a real program. In this note you will learn the O/L flowchart symbols, the pseudocode words, how to **change one into the other**, and how to check an algorithm with a **trace table**.

1. Flowchart symbols



Standard flowchart symbols used in Sri Lankan O/L papers

Symbol	Name	Used for
Rounded rectangle (oval)	Terminal	Start and Stop
Parallelogram	Input / Output	INPUT, DISPLAY, PRINT
Rectangle	Process	Calculations, Total = A + B
Diamond	Decision	A Yes/No question, e.g. Mark >= 35?
Small circle	Connector	Joining flow lines
Arrow	Flow line	Shows the direction of the steps

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> 💡 Rules for a neat flowchart: one Start and one Stop; arrows go top to bottom; a decision diamond has exactly **two** exits labelled **Yes** and **No**; write short text inside each box.

2. Pseudocode words

Pseudocode is not a real language, so small differences are allowed. But in O/L answers we normally use these words, written in CAPITALS:

Word	Meaning	Flowchart symbol
BEGIN / END	Start and end of the algorithm	Terminal
INPUT / READ	Get data	Input/Output
DISPLAY / PRINT	Show a result	Input/Output
Total = A + B	Calculate and store	Process
IF … THEN … ELSE … ENDIF	Selection	Decision
FOR … ENDFOR, WHILE … ENDWHILE, REPEAT … UNTIL	Iteration	Decision + arrow going back

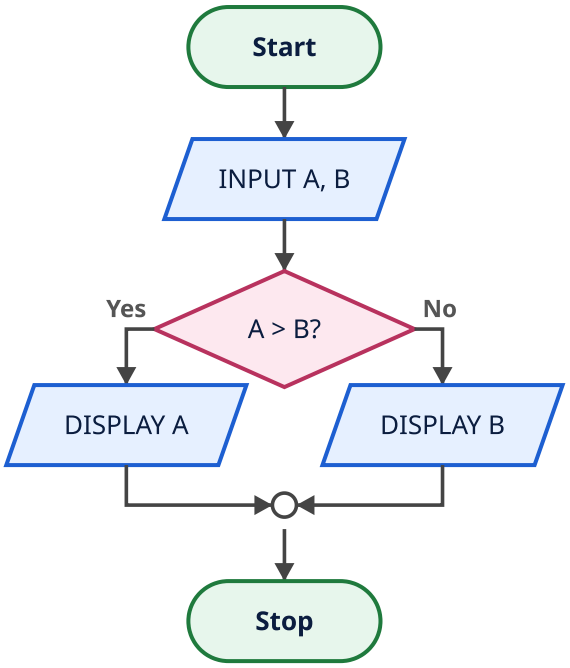
3. Example: the larger of two numbers

Look at the three forms below. Every flowchart box matches one pseudocode line, and every pseudocode line matches one or two lines of code.

Pseudocode

```
BEGIN
  INPUT A, B
  IF A > B THEN
    DISPLAY A
  ELSE
    DISPLAY B
  ENDIF
END
```

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Flowchart – Largest of two numbers

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Largest of two numbers

Pascal

```
program Largest2;
var
  a, b: integer;
begin
  write('Enter first number: ');
  readln(a);
  write('Enter second number: ');
  readln(b);
  if a > b then
    writeln('Largest = ', a)
  else
    writeln('Largest = ', b);
end.
```

Python

```
a = int(input("Enter first number: "))
b = int(input("Enter second number: "))
if a > b:
    print("Largest =", a)
else:
    print("Largest =", b)
```

Sample run 1

```
Enter first number: 45
Enter second number: 72
Largest = 72
```

Sample run 2

```
Enter first number: 90
Enter second number: 34
Largest = 90
```

4. Converting a flowchart into pseudocode

Terminal → BEGIN / END
ආරම්භ/අවසාන → BEGIN / END

Parallelogram → INPUT / DISPLAY
සමාන්තරාස්‍රය → INPUT / DISPLAY

Rectangle → assignment
සෘජුකෝණාස්‍රය → පැවරීම

Diamond, no arrow back → IF
ආපසු ඊතලයක් නැති දියමන්තිය → IF

Diamond with an arrow back → loop
ආපසු ඊතලයක් ඇති දියමන්තිය → ලූපය

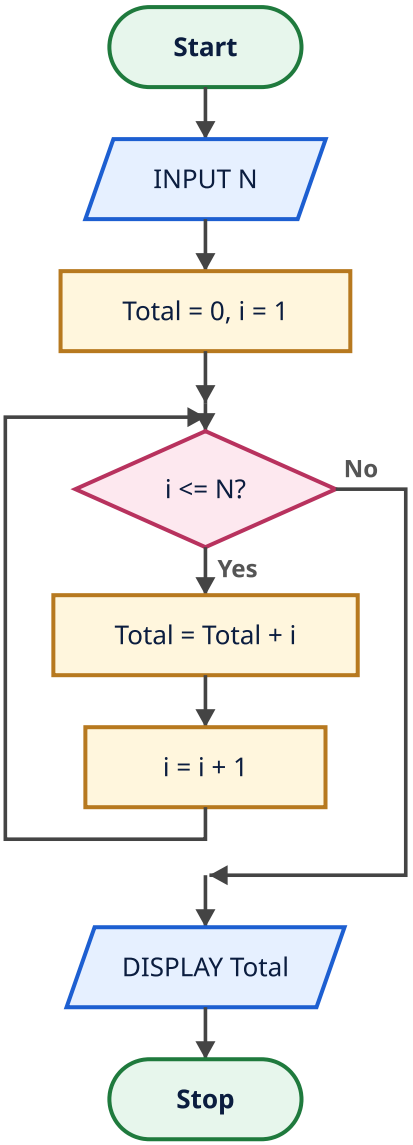
Converting **pseudocode into a flowchart** is the same table read backwards: draw one symbol for each line, and draw an arrow back to the diamond for every loop.

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5. Example with a loop: sum of 1 to N

Pseudocode

```
BEGIN
  INPUT N
  Total = 0
  i = 1
  WHILE i <= N DO
    Total = Total + i
    i = i + 1
  ENDWHILE
  DISPLAY Total
END
```



Flowchart – Sum of the numbers 1 to N

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Sum of the numbers 1 to N

Pascal

```
program SumToN;
var
  n, i, total: integer;
begin
  write('Enter N: ');
  readln(n);
  total := 0;
  i := 1;
  while i <= n do
  begin
    total := total + i;
    i := i + 1;
  end;
  writeln('Sum = ', total);
end.
```

Python

```
n = int(input("Enter N: "))
total = 0
i = 1
while i <= n:
    total = total + i
    i = i + 1
print("Sum =", total)
```

Sample run

```
Enter N: 5
Sum = 15
```

6. Trace tables (dry run)

A **trace table** shows the value of each variable after every step. Doing this on paper is called a **dry run**. It helps you find mistakes before running the program. Here is the trace of the program above for N = 5:

Step	i	Total	i <= 5 ?
start	1	0	–
loop	1	1	Yes
loop	2	3	Yes
loop	3	6	Yes
loop	4	10	Yes
loop	5	15	Yes
check	6	15	No

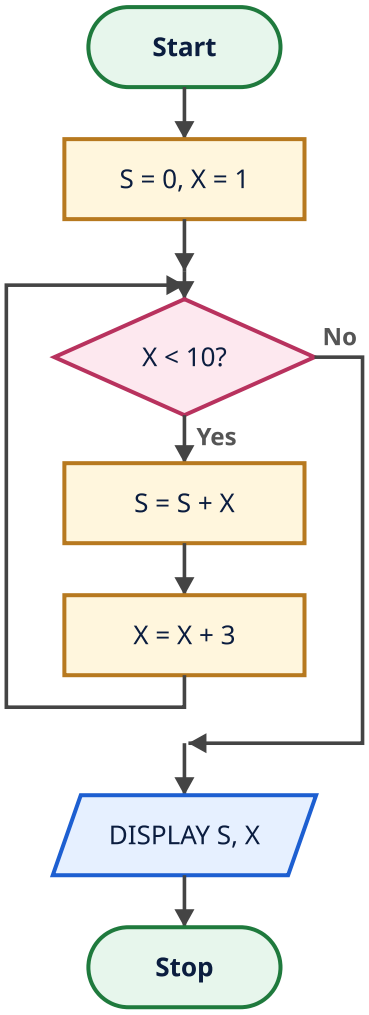
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The last row shows i = 6, so the condition i <= 5 is No and the loop stops. Total = **15**, which matches the real output “Sum = 15”.

7. Try it: trace this loop

Pseudocode

```
BEGIN
  S = 0
  X = 1
  WHILE X < 10 DO
    S = S + X
    X = X + 3
  ENDWHILE
  DISPLAY S, X
END
```



Flowchart – Trace this loop

Step	S	X	X < 10 ?
start	0	1	–
loop	1	4	Yes

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loop	5	7	Yes
loop	12	10	Yes
check	12	10	No

Output: **12 10** (S = 12, X = 10). Check: 1 + 4 + 7 = 12.

Key Words

Flowchart – A diagram of an algorithm using standard symbols and arrows.

Pseudocode – An algorithm written in short English-like lines.

Terminal symbol – Rounded rectangle for Start and Stop.

Input/Output symbol – Parallelogram for INPUT and DISPLAY.

Process symbol – Rectangle for a calculation or assignment.

Decision symbol – Diamond for a Yes/No question.

Connector – Small circle that joins flow lines.

Flow line – Arrow showing the order of steps.

Trace table – A table showing variable values after each step.

Dry run – Following an algorithm by hand on paper.

Assignment – Storing a value in a variable, e.g. Total = 0.

Conversion – Changing a flowchart into pseudocode or the reverse.

Sample Q&A

1. Which symbol is used for a decision?

> **Answer:** A diamond with Yes and No exits.

2. Which symbol is used for INPUT and DISPLAY?

> **Answer:** The parallelogram.

3. What is pseudocode?

> **Answer:** An algorithm written in short English-like lines, close to a program.

4. How do you know a diamond is part of a loop?

> **Answer:** An arrow comes back up to it from below.

5. What is a trace table used for?

> **Answer:** To record variable values step by step and find mistakes (dry run).

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6. Trace S = 0, X = 1; WHILE X < 10: S = S + X, X = X + 3. Give the final S and X.

> **Answer:** S = 12, X = 10.

MCQ

1. The flowchart symbol for Start and Stop is the…

A. rounded rectangle (terminal)
B. parallelogram
C. diamond
D. small circle

2. “Total = A + B” is drawn in a…

A. diamond
B. parallelogram
C. rectangle (process)
D. terminal

3. “DISPLAY Total” is drawn in a…

A. parallelogram
B. diamond
C. circle
D. rectangle

4. How many exits does a decision diamond have?

A. 3
B. 2
C. 1
D. 4

5. A small circle in a flowchart is a…

A. terminal
B. process
C. connector
D. decision

6. Pseudocode is…

A. a type of flowchart symbol
B. a programming language the computer runs
C. machine code
D. an algorithm in English-like lines

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7. A diamond with an arrow coming back to it shows…

A. the end
B. a sequence
C. a loop
D. an input

8. Following an algorithm by hand on paper is called a…

A. upload
B. download
C. compile
D. dry run

9. In the sum 1 to N program with N = 5, the output is…

A. Sum = 5
B. Sum = 15
C. Sum = 10
D. Sum = 21

10. In that program, the value of i when the loop stops is…

A. 6
B. 15
C. 5
D. 0

11. For inputs 45 and 72, the larger-number program displays…

A. Largest = 45
B. Largest = 72
C. Largest = 27
D. Largest = 117

12. Trace: S = 0, X = 1; WHILE X < 10: S = S + X; X = X + 3. Output "S X" is…

A. 12 7
B. 22 13
C. 12 10
D. 10 12

13. When converting a flowchart, the Stop terminal becomes…

A. END
B. DISPLAY
C. ENDIF
D. INPUT

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14. The Yes branch of a decision (no loop) goes after...

A. END
B. ENDIF
C. ELSE
D. THEN

15. Which is a rule for a good flowchart?

A. Three exits from each diamond
B. One Start and one Stop
C. Long paragraphs inside boxes
D. Arrows going in any direction with no labels

Structured Questions

1. Draw the flowchart symbols for (i) terminal (ii) input/output (iii) process (iv) decision and say what each is used for. (4 marks) *(4 marks)*

> Rounded rectangle – Start/Stop; parallelogram – INPUT/DISPLAY; rectangle – calculation/assignment; diamond – Yes/No question (1 each).

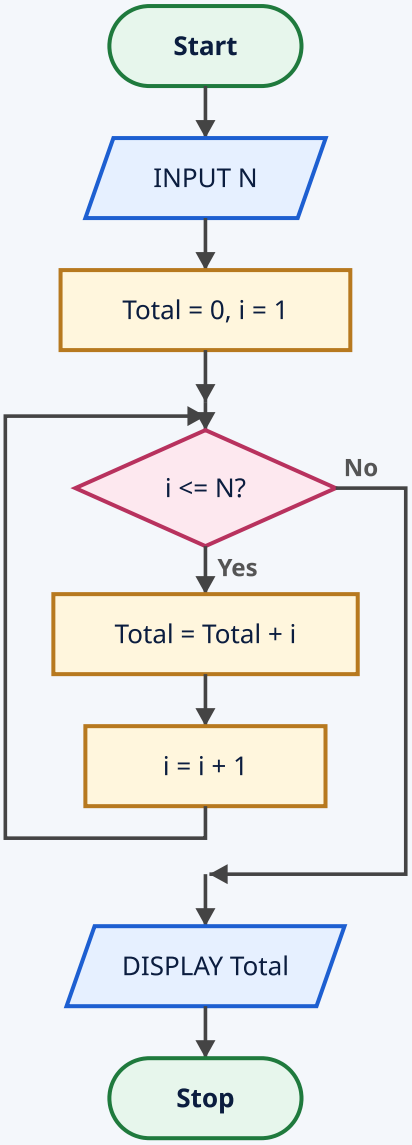
2. Write pseudocode to input two numbers and display the larger one. (4 marks) *(4 marks)*

> BEGIN; INPUT A, B; IF A > B THEN Largest = A ELSE Largest = B ENDIF; DISPLAY Largest; END (input 1, IF 2, display 1).
>
> **Pseudocode**
>
> ```
> BEGIN
>   INPUT A, B
>   IF A > B THEN
>     DISPLAY A
>   ELSE
>     DISPLAY B
>   ENDIF
> END
> ```

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3. Draw a flowchart to find the sum of the numbers 1 to N. (5 marks) *(5 marks)*

Start; input N; Total = 0, i = 1; diamond i <= N?; Yes → Total = Total + i, i = i + 1, arrow back; No → display Total; Stop (1 each for start/stop, input, initialise, loop with arrow back, display).



Flowchart – Sum of the numbers 1 to N

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4. Complete a trace table for S = 0, X = 1; WHILE X < 10: S = S + X; X = X + 3; DISPLAY S, X. (4 marks) *(4 marks)*

S: 0, 1, 5, 12; X: 1, 4, 7, 10; condition Yes, Yes, Yes, No; output 12 10 (1 each).

Step	S	X	X < 10 ?
start	0	1	–
loop	1	4	Yes
loop	5	7	Yes
loop	12	10	Yes
check	12	10	No

5. Give two advantages of pseudocode over a flowchart, and one advantage of a flowchart. (3 marks) *(3 marks)*

Pseudocode: quicker to write and change; closer to real code (2). Flowchart: easy to see the flow as a picture (1).

Summary

- Flowchart = picture; pseudocode = English-like lines.
- Terminal (rounded) = Start/Stop.
- Parallelogram = input/output.
- Rectangle = process; diamond = decision.
- A diamond has Yes and No exits.
- Arrow back to a diamond = loop.
- Convert box by box, line by line.
- A trace table checks an algorithm (dry run).

MCQ answer key – 1.3

1. **A** – Terminal = rounded.
2. **C** – Calculation = process.
3. **A** – Output = parallelogram.
4. **B** – Yes and No.
5. **C** – Connector.
6. **D** – Not run by computer.
7. **C** – Arrow back = repeat.
8. **D** – Dry run.
9. **B** – 1+2+3+4+5 = 15.
10. **A** – Stops when i <= 5 is false.
11. **B** – 72 > 45.

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12. **C** – S=1,5,12; X=4,7,10.
13. **A** – Stop → END.
14. **D** – IF cond THEN yes ELSE no.
15. **B** – One Start, one Stop.

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