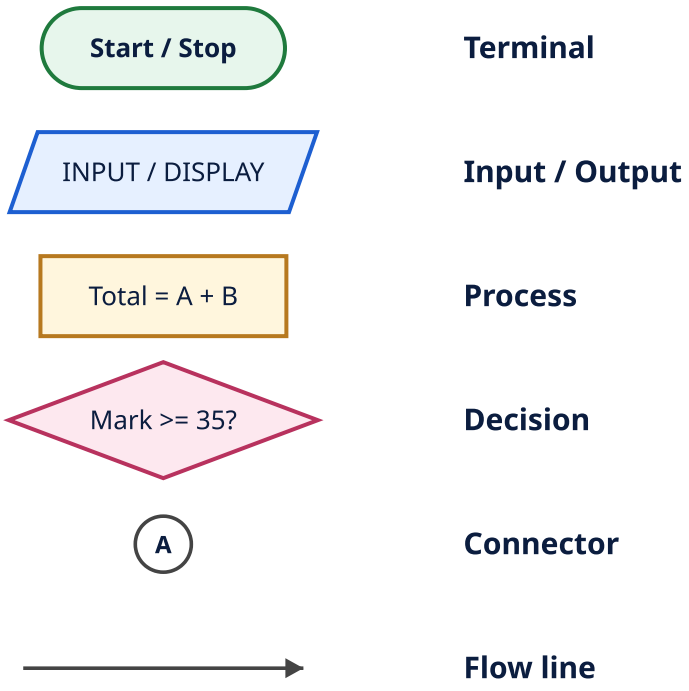
Grade 13 A/L ICT · Lesson 9

9.3 Algorithms: Flowcharts, Pseudocode and Hand Traces

Syllabus 9.3. An **algorithm** is a finite, ordered set of clear steps that solves a problem. We show algorithms as **flowcharts** (standard symbols) or **pseudocode** (structured English), and check them with a **hand trace** (trace table) before coding.

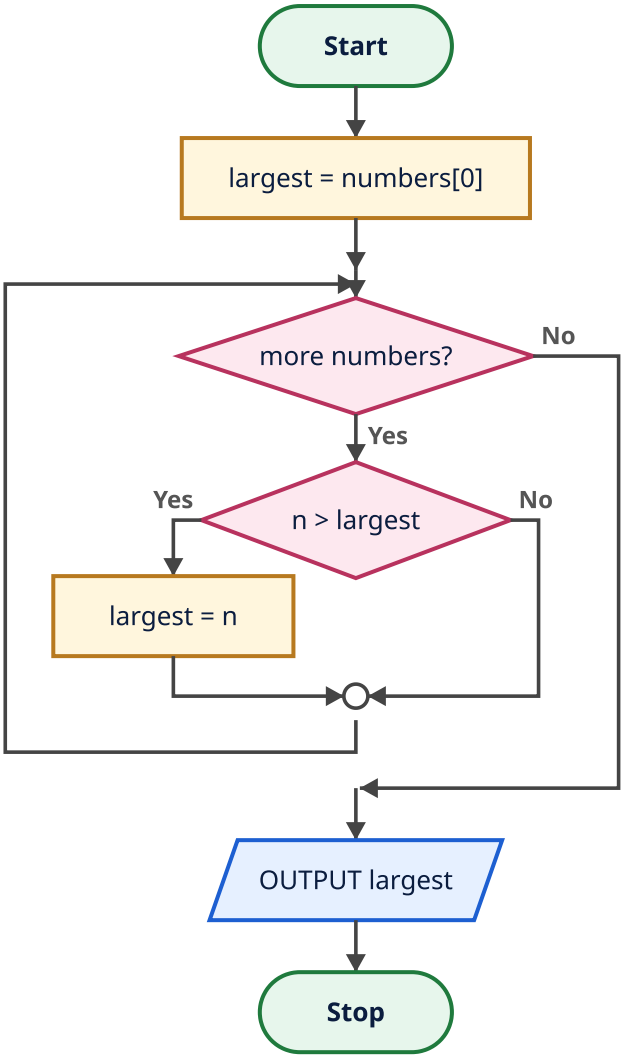
1. Flowchart symbols



Standard flowchart symbols

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2. Finding the largest number



Flowchart: find the largest number

Pseudocode

```
BEGIN
  largest = first number
  FOR each number n DO
    IF n > largest THEN
      largest = n
    ENDIF
  ENDFOR
  DISPLAY largest
END
```

3. Hand trace

n	n > largest?	largest
12	False	12
45	True	45

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7	False	45
30	False	45

🧱 **Worked example: Trace the algorithm for numbers [12, 45, 7, 30].**
largest starts at 12. Only 45 is greater, so largest becomes 45; 7 and 30 are not. Output **45** – the Python program below prints the same.

🐍 Find the largest number

```
numbers = [12, 45, 7, 30]
largest = numbers[0]
for n in numbers:
    if n > largest:
        largest = n
print("Largest:", largest)
```

▶ Output

```
Largest: 45
```

💡 A trace table has one column per variable and one row each time a value changes or a condition is tested.

🚀 **Beyond the syllabus (2026 update)** *Not required for the exam – read for interest.* In 2026 visual debuggers draw live trace tables automatically, but exams still ask you to trace by hand.

Key Words

Algorithm – Finite ordered unambiguous steps to solve a problem.

Flowchart – Diagram of an algorithm using standard symbols.

Pseudocode – Structured English description of an algorithm.

Hand trace – Working through an algorithm by hand to check values.

Trace table – Table recording variable values during a trace.

Terminal symbol – Rounded box marking start or stop.

Process symbol – Rectangle for a calculation or assignment.

Decision symbol – Diamond with a yes/no condition.

Input/output symbol – Parallelogram for reading or displaying data.

Flow line – Arrow showing the order of steps.

Connector – Small circle joining parts of a flowchart.

Dry run – Another name for a hand trace without a computer.

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Sample Q&A

1. Define an algorithm.

> **Answer:** Finite ordered clear steps that solve a problem.

2. Which symbol shows a decision?

> **Answer:** Diamond.

3. Which symbol shows input or output?

> **Answer:** Parallelogram.

4. Output for [12, 45, 7, 30]?

> **Answer:** 45.

5. How many times does largest change after the start?

> **Answer:** Once (12 → 45).

6. Why hand trace?

> **Answer:** To find logic errors before coding.

MCQ

1. A diamond in a flowchart shows a

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

2. A parallelogram shows

A. a connector
B. start or stop
C. input or output
D. a calculation only
E. a decision

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3. A rounded rectangle shows

A. a loop counter
B. input
C. a decision
D. start or stop
E. a file

4. Structured English for an algorithm is

A. a trace table
B. pseudocode
C. bytecode
D. a flowchart
E. machine code

5. The largest of [12, 45, 7, 30] is

A. 94
B. 7
C. 30
D. 12
E. 45

6. In the trace, n > largest is True for

A. 12 only
B. all values
C. no value
D. 7 and 30
E. 45 only

7. A table of variable values while checking an algorithm is a

A. trace table
B. hash table
C. symbol table
D. data dictionary
E. truth table

8. An algorithm must be

A. random
B. unordered
C. finite and unambiguous
D. written only in Python
E. infinite

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9. Which term means: “Finite ordered unambiguous steps to solve a problem”?

A. Algorithm
B. Decision symbol
C. Terminal symbol
D. Connector
E. Pseudocode

10. Which term means: “Diagram of an algorithm using standard symbols”?

A. Dry run
B. Flowchart
C. Process symbol
D. Hand trace
E. Input/output symbol

11. Which term means: “Structured English description of an algorithm”?

A. Pseudocode
B. Trace table
C. Algorithm
D. Decision symbol
E. Flow line

12. Which term means: “Working through an algorithm by hand to check values”?

A. Terminal symbol
B. Connector
C. Input/output symbol
D. Flowchart
E. Hand trace

13. Which term means: “Table recording variable values during a trace”?

A. Pseudocode
B. Process symbol
C. Flow line
D. Trace table
E. Dry run

14. Which term means: “Rounded box marking start or stop”?

A. Connector
B. Decision symbol
C. Hand trace
D. Terminal symbol
E. Algorithm

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15. Which term means: “Rectangle for a calculation or assignment”?

A. Flowchart
B. Trace table
C. Process symbol
D. Dry run
E. Input/output symbol

16. Which term means: “Diamond with a yes/no condition”?

A. Decision symbol
B. Flow line
C. Terminal symbol
D. Pseudocode
E. Algorithm

17. Which term means: “Parallelogram for reading or displaying data”?

A. Hand trace
B. Flowchart
C. Input/output symbol
D. Process symbol
E. Connector

18. Which term means: “Arrow showing the order of steps”?

A. Trace table
B. Decision symbol
C. Pseudocode
D. Flow line
E. Dry run

19. Which term means: “Small circle joining parts of a flowchart”?

A. Terminal symbol
B. Connector
C. Algorithm
D. Input/output symbol
E. Hand trace

20. Which term means: “Another name for a hand trace without a computer”?

A. Flow line
B. Trace table
C. Flowchart
D. Process symbol
E. Dry run

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Structured Questions

1. Draw and name five flowchart symbols. *(5 marks)*

> Terminal; process; decision; input/output; flow line/connector.

2. Write pseudocode to find the largest of a list. *(4 marks)*

> largest = first; FOR each n; IF n > largest THEN largest = n; DISPLAY.

3. Draw a flowchart to find the largest of a list. *(6 marks)*

> Start; set largest; loop decision; compare decision; output; stop.

4. Complete a trace table for [12, 45, 7, 30]. *(5 marks)*

> 12 F 12; 45 T 45; 7 F 45; 30 F 45; output 45.

5. State three properties of a good algorithm. *(3 marks)*

> Finite; unambiguous; ordered steps with input/output.

Summary

- An algorithm is a finite set of clear steps.
- Flowcharts use standard symbols.
- Pseudocode is structured English.
- Trace tables check values by hand.
- Trace before you code.

MCQ answer key – 9.3

1. **B** – Decision.
2. **C** – I/O.
3. **D** – Terminal.
4. **B** – Pseudocode.
5. **E** – 45.
6. **E** – Only 45.
7. **A** – Trace table.
8. **C** – Finite and clear.
9. **A** – Algorithm – Finite ordered unambiguous steps to solve a problem.
10. **B** – Flowchart – Diagram of an algorithm using standard symbols.
11. **A** – Pseudocode – Structured English description of an algorithm.
12. **E** – Hand trace – Working through an algorithm by hand to check values.
13. **D** – Trace table – Table recording variable values during a trace.
14. **D** – Terminal symbol – Rounded box marking start or stop.
15. **C** – Process symbol – Rectangle for a calculation or assignment.

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16. **A** – Decision symbol – Diamond with a yes/no condition.
17. **C** – Input/output symbol – Parallelogram for reading or displaying data.
18. **D** – Flow line – Arrow showing the order of steps.
19. **B** – Connector – Small circle joining parts of a flowchart.
20. **E** – Dry run – Another name for a hand trace without a computer.

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