5.2 Flowcharts, tracing and test data

Name: _____ Class: _____ Date: _____ **Total: 23 marks**

KEY WORDS flowchart • sequence • selection • iteration • trace table • pseudocode • boundary

Objective

Build the skills to answer exam questions on **flowcharts, tracing and testing** – flowchart symbols, sequence, selection and iteration, trace tables and test data.

You must be able to:

- name and use the standard **flowchart** symbols
- identify **sequence** , **selection** and **iteration** in an algorithm
- complete a **trace table** for a flowchart or **pseudocode**
- choose normal, **boundary** and invalid test data from a specification

1 Key knowledge and worked examples

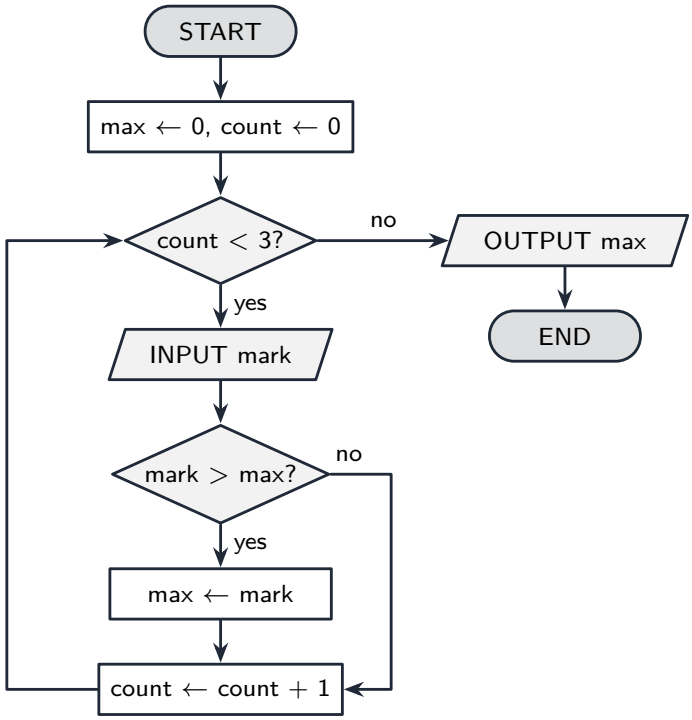
Study these first. Each one shows the method for a question type used later.

■ **Key knowledge: flowchart symbols**

Symbol	Use
rounded rectangle	START, END
parallelogram	INPUT, OUTPUT
rectangle	process: `total ← total + x`
diamond	decision with yes and no exits

`x ← 5` is assignment: store 5 in `x`.

■ Worked example: tracing a flowchart



Inputs 62, 85, 71.

`count`	`mark`	`mark > max?`	`max`	Output
0			0	
0	62	yes	62	
1	85	yes	85	
2	71	no	85	
3				85

1. The diamond `count < 3?` with the arrow back is **iteration**; `mark > max?` is **selection**.
2. Output **85**. With inputs -5, -8, -2 it outputs 0, which is wrong: `max` should start at the first mark.

■ Worked example: test data

A quiz accepts a score from 0 to 50.

Type	Values	Expected
normal	23, 41	accepted
boundary	0, 50	accepted
boundary (just outside)	-1, 51	rejected
invalid	-30, 200, “abc”	rejected

2 Practice

2.1 Name the flowchart symbol for: (i) `OUTPUT total`; (ii) `IF age >= 18`; (iii) `count ← count + 1`. [3]

2.2 Trace the flowchart above for the inputs 30, 75, 75, and state the output. [3]

2.3 A password must be 8 to 16 characters long. Give **one** normal, **two** boundary and **one** invalid length. [2]

3 Exam-style questions

3.1 Which construct does a diamond whose "yes" arrow loops back to an earlier step show? [1]

- **A** sequence
- **B** selection only
- **C** iteration
- **D** abstraction

3.2 What is the output of this pseudocode? [1]

```
x ← 1
loop while x < 30
    x ← x * 2
end loop
output x
```

- **A** 16
- **B** 30
- **C** 32
- **D** 64

3.3 Which value is boundary data for an age from 11 to 18 inclusive? [1]

- **A** 14
- **B** 18
- **C** 25
- **D** "eleven"

3.4 An algorithm counts how many of the numbers entered are even. It stops when -1 is entered.

```
count ← 0
input N
loop while N ≠ -1
    if N mod 2 = 0 then
        count ← count + 1
    end if
    input N
end loop
output count
```

(a) Complete a trace table for the inputs 4, 7, 10, 0, -1, with columns `N`, `N mod 2 = 0`? and `count`. State the output. [4]

(b) Identify **one** example of selection and **one** of iteration in the algorithm. [2]

(c) Draw a flowchart for the algorithm. [4]

(d) State the output if the first number entered is -1, and whether this is correct. [2]