

CANDIDATE
NAME

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CENTRE
NUMBER

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CANDIDATE
NUMBER

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0478/02

For examination from 2029

1 hour 45 minutes

No additional materials are needed.

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen. Do **not** use correction fluid or tape.
- Do **not** write on any bar codes.
- Calculators can be used in this paper.
- Use Python 3.10 to write all your programs.

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [].
- No marks will be awarded for using brand names of software packages or hardware.

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[Turn over

- 1 Tick (✓) **one** box to complete the description of abstraction.

Abstraction is a stage in algorithm design. Abstraction means:

- A** amending an algorithm for a given context using a flowchart. ☐
- B** dividing problems into smaller, more manageable subproblems. ☐
- C** creating a simplified model to represent the essential features of a problem. ☐
- D** separating a problem into inputs, processes, outputs and storage. ☐

[1]

- 2 Tick (✓) **one** box to complete this sentence.

The purpose of the Python list function `.pop(7)` is to:

- A** remove and return the item in the list at index 6. ☐
- B** remove and return the item in the list at index 7. ☐
- C** remove and return the last item in the list. ☐
- D** remove and return the number 7 from the list. ☐

[1]

- 3 Four uses of arithmetic operators and six results are shown.

Draw **one** line from each use of arithmetic operator to the correct result.
Not all results will be used.

use of arithmetic operator

result

5002 // 4

1250.5

1455.5

147 % 4

216

8733 / 6

1250

6 ** 3

1455

3

[4]

- 4 (a) State the purpose of verification.

.....
 [1]

- (b) Explain how the double entry check works.

.....

 [2]

- 5 (a) A format check is a type of validation check.

State the purpose of a format check.

.....
 [1]

- (b) A value input into a computer system must have exactly six characters.

- (i) Identify the validation check used to test whether the value input meets this requirement.

..... [1]

- (ii) Write the program code to:

- input a string with an appropriate prompt
- check whether the string has exactly six characters
- display an appropriate message if the string has exactly six characters
- display an error message if the string does **not** have exactly six characters
- re-input the string until a valid string is entered.

.....

 [4]

- 6 (a) A list of numbers is shown.

68	50	20	0	100	45	10	70
----	----	----	---	-----	----	----	----

Show the steps needed to use a merge sort to sort these numbers into descending order. Start from the position shown.

68	50	20	0	100	45	10	70
----	----	----	---	-----	----	----	----

[3]

- (b) Describe the steps a binary search takes to find the number 98 in the following list.

120	98	75	53	40	35	26
-----	----	----	----	----	----	----

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..... [4]

- 7 This program is intended to allow 1000 positive integers to be input and stored in a one-dimensional (1D) list. The integers are added together as they are input and the highest value is identified. At the end of the program, the highest number, the total and the average of the numbers are output.

```

01 numbers = [0] *1000
02 highest = 2000
03 total = 0
04 while count in range(1000):
05     print('Please input integer number ', count + 1)
06     numbers[count] = int(input())
07     total = total + count
08     if numbers[count] > highest:
09         highest = numbers[count]
10 print('The highest number is ', highest)
11 print('The total is ', total)
12 print('The average is ', highest / 1000)

```

- (a) Identify the line numbers of **four** errors and suggest a correction for each error.

error 1 line number

correction

.....

error 2 line number

correction

.....

error 3 line number

correction

.....

error 4 line number

correction

.....

[4]

- (b) Write the program statement to output the average of the numbers rounded to **two** decimal places.

.....

..... [2]

8 Consider this program.

```
g = -5000
s = 5000
t = 0
a = 0
limit = int(input())
for i in range(limit):
    value = int(input())
    if value > g:
        g = value
    elif value < s:
        s = value
    t = t + value
a = t / limit
print('g = ', g, 's = ', s, 't = ', t, 'a = ', a)
```

(a) Use the following input data to complete the trace table for the given program:

6, 12, -50, 1200, 0, -120, 17

g	s	t	a	limit	i	value	output

[6]

(b) Outline the purpose of this program.

.....

.....

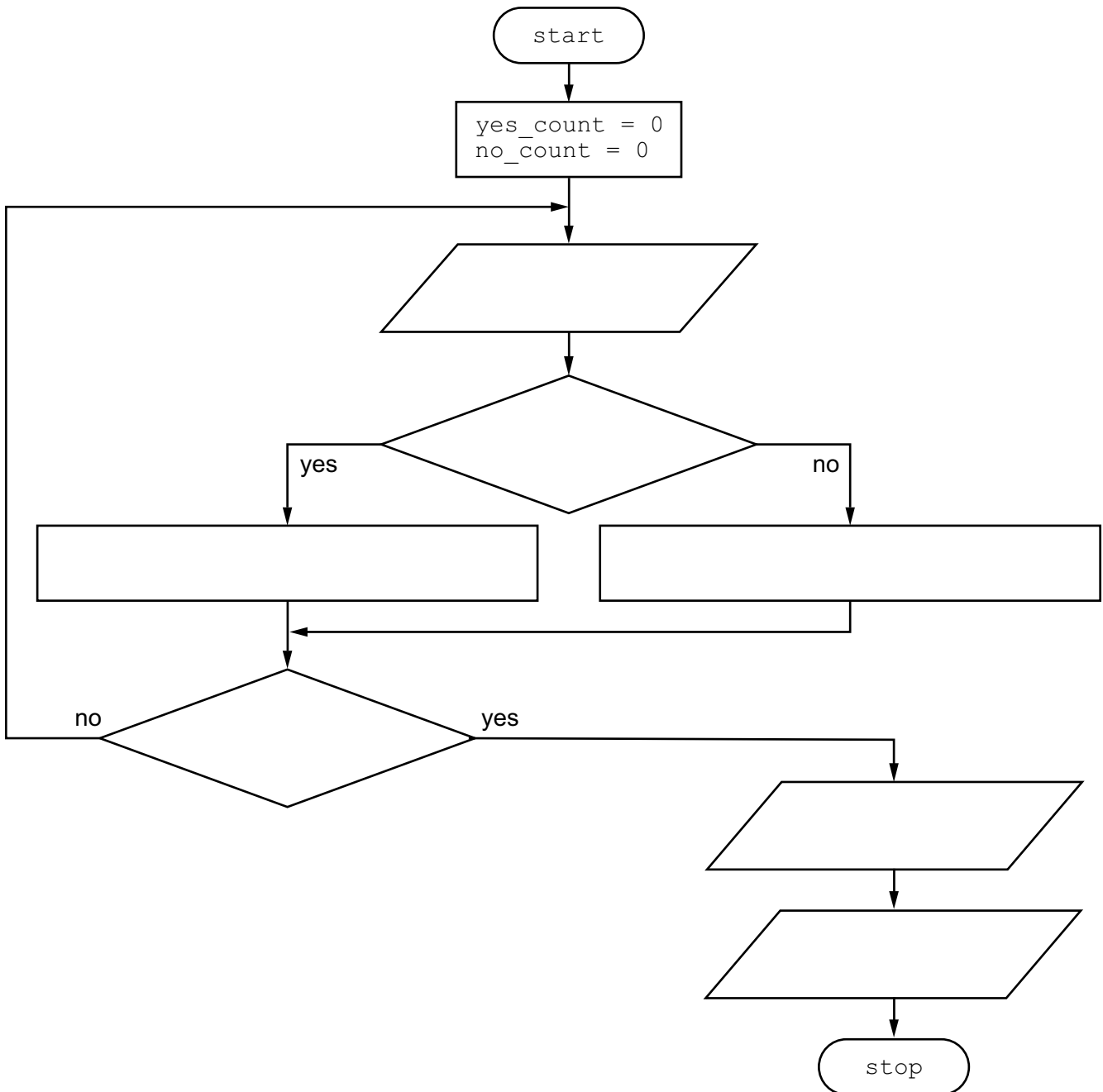
.....

..... [2]

- 9 The flowchart shows an algorithm that is used to count the number of students who have achieved a mark of at least 60 in an exam.

There are 300 students. If the mark is 60 or higher, the variable `yes_count` is incremented by 1. If the mark is less than 60, the variable `no_count` is incremented by 1. The algorithm repeats until all 300 marks have been input. The values of `yes_count` and `no_count` are output.

Complete this flowchart.



[6]

10 (a) Variables can be either global or local.

State **one** advantage of:

global variables

.....

local variables.

.....

[2]

(b) Explain how procedures make a program easier to maintain.

.....

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..... [3]

11 Data may be stored in a file so that it can be reused.

Write the program code to:

- read and output the contents of the text file 'Quote.txt'
- convert the contents of the text file 'Quote.txt' into UPPERCASE and output the result.

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..... [5]

- 12** A database table `STUDENT` stores data about students and the identifier for their first choice A Level subject. A second table `SUBJECT` stores data about the subjects available at A Level.

`STUDENT`

field	description
StudentID	a unique identifier – a mixture of letters and numbers
StudentName	the name of the student as family name followed by first name
TutorGroup	the student's tutor group name
SubjectID	identifier for a subject

`SUBJECT`

field	description
SubjectID	a unique identifier – letters, numbers or a mixture
SubjectName	the name of the subject
PracticalExams	the number of practical examinations
TheoryExams	the number of theory examinations
MaxClassSize	the maximum size of the class

- (a)** Identify the foreign key in the `STUDENT` table and state its purpose.

field

purpose

.....

[2]

- (b)** Complete the table. Write **one** field from the given tables that will be appropriate for each data type.

Both fields must be different.

data type	field
text	
integer	

[1]

- (c) Complete the structured query language (SQL) statement to list only the student name and tutor group of all students who choose to study the subject computer science.

SELECT
FROM
INNER
ON =
WHERE =;
[5]

- 13** A program is needed to test a random number generator. 1 000 000 integers between 1 to 6 inclusive are generated. The program will find the number of times each integer occurs.

Two lists are required to store the data:

- `random_numbers` is a one-dimensional (1D) list to store 1 000 000 random integers.
- `count_store` is a two-dimensional (2D) list to store the integers 1 to 6 in the first column and the number of times each of the integers 1 to 6 is generated in the second column.

(a) Write the program code to initialise:

- all the elements of `random_numbers` to 0
- the elements of the first column of `count_store` to the integers 1 to 6 inclusive
- all elements of the second column of `count_store` to 0.

.....

 [2]

(b) Write the program code to generate 1 000 000 random integers between 1 and 6 inclusive and store them in `random_numbers`

.....

 [3]

- (c) Write the program code to find the number of times each random integer was generated and store the results in `count_store`

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..... [4]

..... [6

[6]