OCR
Oxford Cambridge and RSA

Friday 27 May 2022 – Afternoon

GCSE (9–1) Computer Science

J277/02 Computational thinking, algorithms and programming

Time allowed: 1 hour 30 minutes

Do not use:
- a calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) MyCSTutor.co.uk

Last name Computer Science Worked Solutions

INSTRUCTIONS
- Use black ink.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **80**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **20** pages.

ADVICE
- Read each question carefully before you start your answer.

Answer **all** the questions.

SECTION A

1 **(a)** Tick (✓) **one** box in each row to identify whether the OCR Reference Language code given is an example of selection or iteration.

OCR Reference Language code	Selection	Iteration

`for i = 1 to 10`
`  print(i)`
`next i`
		✓

`while score != 0`
`  playgame()`
`endwhile`
		✓

`if playerHit() then`
`  score = 0`
`endif`
	✓	

`switch bonus:`
`  case 0:`
`  score = 9`
`  case 1:`
`  score = 7`
`  case 2:`
`  score = 5`
`endswitch`
	✓	

[4]

(b) Write pseudocode to increment the value held in the variable `score` by one.

.....

score = score + 1

..... **[1]**

(c) State the name of each of the following computational thinking techniques.

Breaking a complex problem down into smaller problems.

.....

Decomposition

.....

Hiding or removing irrelevant details from a problem to reduce the complexity.

.....

Abstract

.....

[2]

2 A fast food restaurant offers half-price meals if the customer is a student or has a discount card. The offer is not valid on Saturdays.

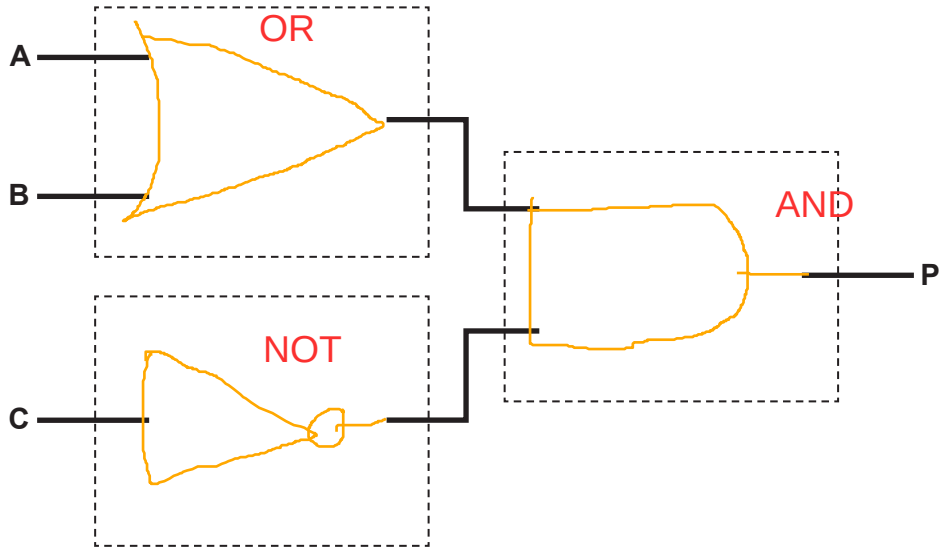
A computer system is used to identify whether the customer can have a half-price meal.

The table identifies the three inputs to the computer system:

Input	Value
A	Is a student
B	Has a discount card
C	The current day is Saturday

(a) The logic system **P = (A OR B) AND NOT C** is used.

(i) Complete the following logic diagram for **P = (A OR B) AND NOT C** by drawing one logic gate in each box.



[3]

(ii) A truth table can be produced for this logic circuit.

Describe the purpose of a truth table.

.....

Shows all possible inputs and the dependent output for each input

.....

.....

..... **[2]**

(iii) State how many rows (excluding any headings) would be required in a truth table for the logic expression:

P = (A OR B) AND NOT C

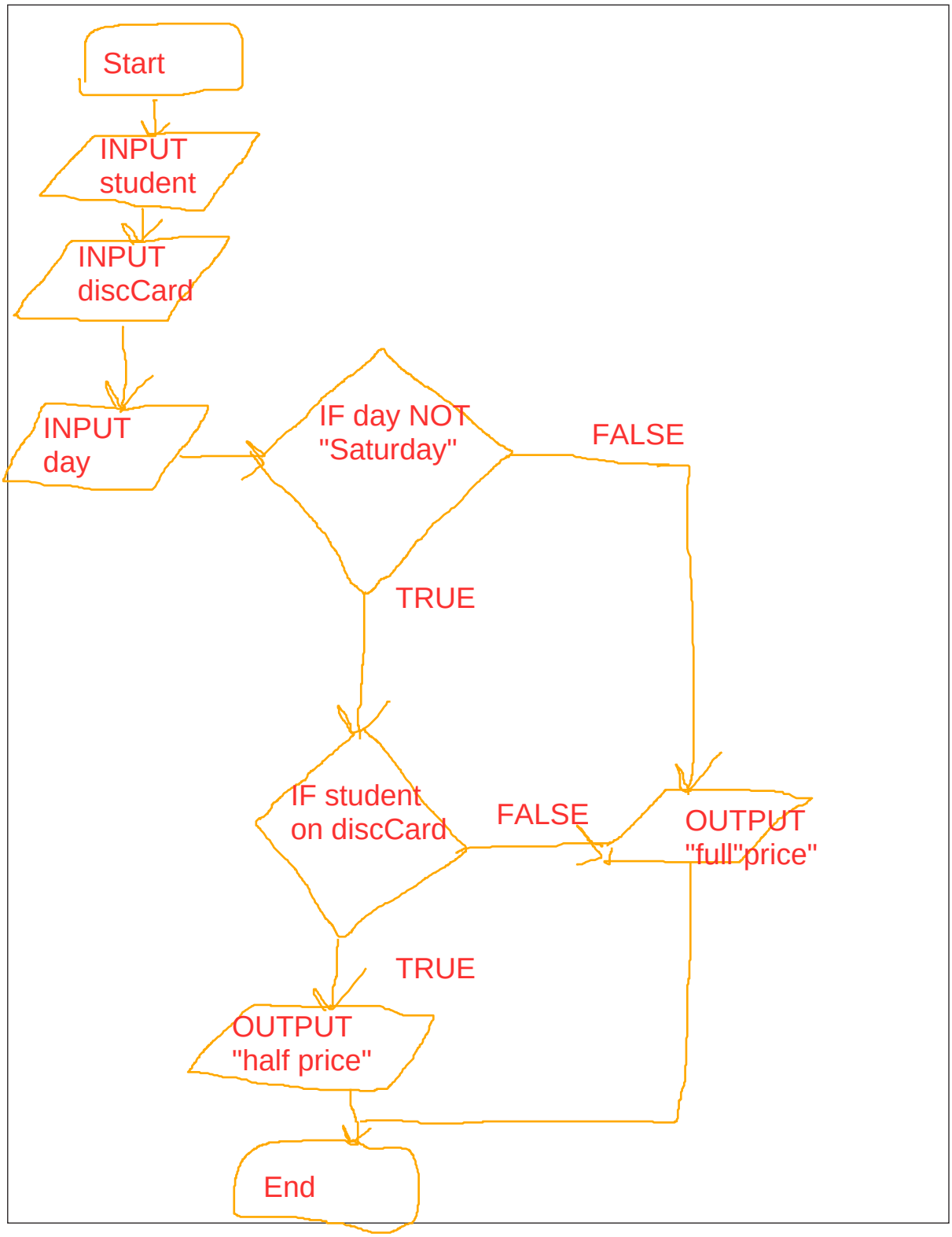
5 inputs + 3 outputs = 8

..... **[1]**

(b) The restaurant needs an algorithm designing to help employees work out if a customer can have a half price meal or not. It should:

- input required data
- decide if the customer is entitled to a discount
- output the result of the calculation.

Design the algorithm using a flowchart.



[5]

(c) The restaurant adds a service charge to the cost of a meal depending on the number of people at a table. If there are more than five people 5% is added to the total cost of each meal.

Customers can also choose to leave a tip, this is optional and the customer can choose between a percentage of the cost, or a set amount.

Identify **all** the additional inputs that will be required for this change to the algorithm.

.....

Number of people at table

.....

Choice between percentage + value

.....

..... **[2]**

(d) Each member of staff that works in the restaurant is given a Staff ID. This is calculated using the following algorithm.

```
01  surname = input("Enter surname")
02  year = input("Enter starting year")
03  staffID = surname + str(year)
04  while staffID.length < 10
05       staffID = staffID + "x"
06  endwhile
07  print("ID " + staffID)
```

(i) Define the term **casting and** give the line number where casting has been used in the algorithm.

Definition Changing a data type to another type

.....

Line number 03

[2]

(ii) Complete the following trace table for the given algorithm when the surname "Kofi" and the year 2021 are entered.

You may not need to use all rows in the table.

Line number	surname	year	staffID	Output
01	Kofi			
02		2021		
03			Kofi2021	
05			Kofi2021x	
05			Kofi2021xx	
07				ID Kofi2021xx

[4]

3 A program stores the following list of positive and negative numbers. The numbers need sorting into ascending order using a merge sort.

45	12	–99	100	–13	0	17	–27

(a) The first step is to divide the list into individual lists of one number each. This has been done for you.

Complete the merge sort of the data by showing each step of the process.

45	12	–99	100	–13	0	17	–27

12 45 -99 100 -13 0 -27 17

-99 12 45 100 -27 -13 0 17

-99 -27 -13 0 12 17 45 100

[3]

(b) Once the numbers are in order, a binary search can be run on the data.

Describe the steps a binary search will follow to look for a number in a sorted list.

Start at middle number

If middle = target, we have found

If middle is larger, discard left half

If middle is smaller, discard right half

Repeat until number found, or remaining list is empty (number not in list)

[4]

(c) A linear search could be used instead of a binary search.

Describe the steps a linear search would follow when searching for a number that is **not** in the given list.

Starts with first value in list, checking every value in order

[2]

4 Jack is writing a program to add up some numbers. His first attempt at the program is shown.

```
a = input("Enter a number")
b = input("Enter a number")
c = input("Enter a number")
d = input("Enter a number")
e = input("Enter a number")
f = (a + b + c + d + e)
print(f)
```

(a) Give **two** ways that the maintainability of this program could be improved.

1 .....

Comments

.....

2 Subroutines .....

.....

[2]

(b) Jack's program uses the addition `(+)` arithmetic operator. This adds together two numbers.

(i) State the purpose of each of the arithmetic operators in the table.

Arithmetic operator	Purpose
*	Multiply
/	Divide

[2]

(ii) Complete the description of programming languages and translators by writing the correct term from the box in each space.

continues	crashes	debugging	error	executable
high-level	interpreter	language	low-level	many
no	one	stops	with	without

Jack writes his program in a high-level language. This needs to be translated into assembly or machine code before it can be executed. This is done using a translator.

One type of translator is an interpreter. This converts one line of code and then executes it, before moving to the next line. It stops when an error is found, and when corrected continues running from the same position. This translator is helpful when debugging code.

A second type of translator is a compiler. This converts all of the code and produces an error report. The code will not run until there are no errors. The executable file produced can be run without the compiler.

[5]

(c) Jack decides to improve his program. He wants to be able to input how many numbers to add together each time the algorithm runs, and also wants it to calculate and display the average of these numbers.

Write an algorithm to:

- ask the user to input the quantity of numbers they want to enter and read this value as input
- repeatedly take a number as input, until the quantity of numbers the user input has been entered
- calculate and output the total of these numbers
- calculate and output the average of these numbers.

```
num = input("Enter how many numbers")
 for x = 1 to num
     temp = input("Enter a number")
      total = total + temp
next x
print(total)
print(total / num)
```

[6]

SECTION B

We advise you to spend at least 40 minutes on this section.

Some questions require you to respond using either the OCR Exam Reference Language or a high-level programming language you have studied. These are clearly shown.

5 Customers at a hotel can stay between 1 and 5 (inclusive) nights and can choose between a basic room or a premium room.

(a) A typical booking record is shown in the table:

`firstName`	Amaya
`surname`	Taylor-Ling
`nights`	3
`room`	Premium
`stayComplete`	False

(i) State the most appropriate data type for the following fields:

Nights Integer

Room String

[2]

(ii) Give the name of **one** field that could be stored as a Boolean data type.

stayComplete

[1]

(iii) Booking records are stored in a database table called `TblBookings`.

The following SQL statement is written to display all customer bookings that stay more than one night.

```
SELECT ALL
FROM TblBookings
IF Nights < 1
```

The SQL statement is incorrect.

Rewrite the SQL statement so that it is correct.

SELECT *
FROM TblBookings
WHERE Nights > 1

[4]

(b) When a new booking is recorded, the details are entered into a program to validate the values. The following criteria are checked:

- `firstName` and `surname` are not empty (1)
- `room` is either "basic" or "premium" (2)
- `nights` is between 1 and 5 (inclusive). (3)

If any invalid data is found "NOT ALLOWED" is displayed. (4)
If all data is valid "ALLOWED" is displayed. (5)

(i) Complete the following program to validate the inputs.

You must use **either**:
- OCR Exam Reference Language, **or**
- a high-level programming language that you have studied.

```
firstName = input("Enter a first name")
surname = input("Enter a surname")
room = input("Enter basic or premium")
nights = input("Enter between 1 and 5 nights")
stayComplete = False
valid = True
if firstname == "" or surname == "" then (1)
    valid = False
end if
if room != "basic" and room != "premium" then (2)
    valid = False
end if
if nights <1 or nights > 5 then (3)
    valid = False
endif
if valid then
    print("ALLOWED") (5)
else
    print("NOT ALLOWED") (4)
endif
```

.....

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..... **[5]**

(ii) Complete the following test plan to check whether the number of nights is validated correctly.

Test data (number of nights)	Type of test	Expected output
2	NORMAL	ALLOWED
1	Boundary	ALLOWED
100000	Erroneous / Invalid	NOT ALLOWED

[3]

(c) A Basic room costs £60 each night. A Premium room costs £80 each night.

(i) Create a function, `newPrice()`, that takes the number of nights and the type of room as parameters, calculates and returns the price to pay.

You do **not** have to validate these parameters.

You must use **either**:
- OCR Exam Reference Language, **or**
- a high-level programming language that you have studied.

```
function newPrice(nights,room)
    if room == "basic" then
        price = 60 * nights
    elseif room == "premium" then
        price = 80 * nights
    endif
    return price
endfunction
```

[4]

(ii) Write program code, that uses `newPrice()`, to output the price of staying in a Premium room for 5 nights.

You must use **either**:
- OCR Exam Reference Language, **or**
- a high-level programming language that you have studied.

```
print(newPrice("premium",5))
```

use parameters

[3]

(d) The hotel has nine rooms that are numbered from room 0 to room 8.

The number of people currently staying in each room is stored in an array with the identifier `room`.

The index of `room` represents the room number.

Array `room`

Index	0	1	2	3	4	5	6	7	8
Data	2	1	3	2	1	0	0	4	1

The following program counts how many people are currently staying in the hotel.

```
for count = 1 to 8
    total = 0
    total = total + room[count]
next count
print(total)
```

When tested, the program is found to contain **two** logic errors.

Describe how the program can be refined to remove these logic errors.

need to set for count = 0 to 8

need to put total = 0 outside the loop so not reset every iteration

[2]

(e) The hotel car park charges £4 per hour. If the car is electric, this price is halved to £2 per hour.

Write an algorithm to:

- take as input the number of hours the user has parked and whether their car is electric or not
- calculate and output the total price
- repeat continually until the user enters 0 hours.

You must use **either**:

- OCR Exam Reference Language, **or**
- a high level programming language that you have studied.

```
while hours != 0
    hours = input("Enter hours")
    electric = input("Enter Y for electric, N for normal ")
     if electric == "Y" then
       price = hours * 2
     elseif electric == "N" then
       price = hours * 4
     endif
     print(price)
endwhile
```

[6]

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).