



MINISTRY OF EDUCATION, SINGAPORE
in collaboration with
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
General Certificate of Education Advanced Level
Higher 2



COMPUTING

9597/02

Paper 2

October/November 2018

3 hours

Additional Materials: Answer Paper

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO NOT WRITE IN ANY BARCODES.

Answer **all** questions.

At the end of the examination, fasten your work securely together.
The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **9** printed pages and **3** blank pages.



Singapore Examinations and Assessment Board



CAMBRIDGE
International Examinations

Answer **all** questions.

- 1 A mobile phone company has an option for Pay As You Go usage. Customers have to purchase credit in advance. The credit is used to pay for texts, calls and data. Customers can buy additional credit at any time.

The company requires software to allow their Pay As You Go customers to do the following tasks online:

- check credit balance
- check data usage
- check call usage
- pay for credit

A software company was employed to put together a project team to produce the software.

(d) The software could have been designed using different techniques.

(i) Name **and** describe **two** design techniques that may have been used. [4]

(ii) Explain why it is important for each member of the design team to use the same technique. [2]

(iii) A customer's mobile phone number needs to be validated on entry.

Draw a flowchart to represent an algorithm for this validation. [4]



- (f) The software is intended for use on hand-held devices.

Describe **two** ways that users can keep their data secure on these devices. [4]

- (g) A member of the project team had the task of ensuring that social and ethical issues were considered.

Describe **one** example of each of these issues that this member of the team might have considered. [4]



2 The following algorithm calculates the average mark for a group of students.

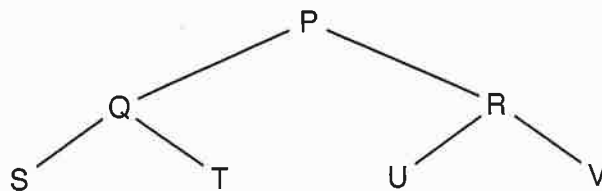
```

01 FOR Counter ← 1 TO NumberOfStudents
02     Total ← 0
03     INPUT Mark
04     Total ← Total + Mark
05 ENDFOR
06 Average ← Total / NumberOfStudents
07 OUTPUT Average

```

- (a) There is an error in this algorithm causing an incorrect result. Describe the error and explain the change required to correct this error. [3]
- (b) State the name of this type of error. [1]
- (c) The lowest mark in the exam is 0 and the highest is 100. Give an example from each of the appropriate test cases which could be used to test the algorithm. [4]
- (d) Name and describe a suitable technique that could be used to manually identify errors in the algorithm. [2]

3 (a) A binary tree is as follows:



- (i) State the in-order sequence. [1]
- (ii) State the pre-order sequence. [1]



(b) A 1D array, *Value*, stores a list of scores as follows:

Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Score	2	6	15	23	36	48	50	58	64	69	74	79	86	92	99

- (i) Using a linear search, state how many comparisons will be required to find the score of 64. [1]

The following binary search algorithm could be used to search the list of scores.

```

01 Lower ← LowestIndex
02 Upper ← HighestIndex
03 REPEAT
04     Middle ← (Lower + Upper) DIV 2
05     IF SearchItem > Value[Middle]
06         THEN
07             Lower ← Middle + 1
08         ELSE
09             Upper ← Middle - 1
10     ENDIF
11 UNTIL Value[Middle] = SearchItem OR Lower > Upper
12 OUTPUT "Score found at position " Middle

```

- (ii) Score 80 is not in the list.

When searching for this score, state the values that will be examined. [2]

- (iii) When searching for a score of 80, this algorithm outputs:

Score found at position 12

Describe how the algorithm gives this incorrect output. [2]

- (iv) Describe how the algorithm could be changed to give a suitable message if the score is not in the list. [3]

4 A university allows students to access the university network from home.

- (a) The university server has a firewall.

Describe **two** ways that a firewall can be used to block unauthorised access to the network. [2]

- (b) The university wishes to restrict access to inappropriate websites from within its network.

Describe **two** methods that could be used to restrict access to inappropriate websites. [4]

- (c) The university is concerned about the possible loss of data from their local servers.

Describe a strategy that could be used to prevent data loss. [2]

- (d) The university has its own intranet.

Describe **two** benefits that the intranet might provide for students. [2]



- 5 The organisers of a diving championship have created software to calculate and show the total score for each diver.

There are nine judges scoring each dive. The two best scores and the two worst scores are ignored. The other five scores are added together to give the diver's total score.

- (a) Write an algorithm to take in the nine scores, delete the best two and the two worst scores, and total the five remaining scores. [4]

There are 10 divers in the final. The scoreboard shows the order of diving.

Order	Diver name	Total score
1	Daniel Tan	
2	Parker Lam	
3	Mohamad Noor	
4	Hariz Yazid	
5	Sheryl Xuan	
6	Karl Lim	
7	Elaine Ning	
8	Nadyia Esmadi	
9	Cai Ng	
10	Hamid Mahmood	

- (b) The programmers decided to use a 1D array for the scores. They will also use a bubble sort to sort the scores into descending order.

- (i) Explain how a bubble sort can be used to arrange the scores into a descending or ascending order. [2]

This is the bubble sort algorithm for sorting into descending order:

```

01 WHILE NoSwaps = FALSE
02     NoSwaps ← TRUE
03     UpperBound ← ListLength
04     FOR Posn ← 0 TO .....A.....
05         IF List[Posn] < .....B.....
06             THEN
07                 // Swap
08                 NoSwaps ← .....C.....
09                 Temp ← List[Posn]
10                 List[Posn] ← List[Posn + 1]
11                 List[Posn + 1] ← .....D.....
12             ENDIF
13     ENDFOR
14 ENDWHILE

```

- (ii) Write the pseudocode for A, B, C and D in the algorithm. [4]



(c) During the first round of dives, the sorted scores for five divers are:

48
45
40
37
36

The sixth diver scores 42 and the software appends the score to the list as follows:

48
45
40
37
36
42

- (i) State the number of passes needed through the list to return the list to its sorted order. [1]
- (ii) Explain why the bubble sort is efficient in this example. [2]
- (iii) Name another sort method that could have been used in this situation.

Compare the speed of sorting the divers' scores in your named method with using the bubble sort. [2]



- 6 Customers want to buy tickets for a diving championship that takes place over three days. There are two sessions of diving each day.

Customers use a ticket ordering website to buy their tickets.



- (a) State the type of user interface that the ticket ordering website uses. [1]

- (b) All ticket sales are stored on a database server in the following tables:

`CUSTOMER(CustomerID, CustomerName, Email, ContactNumber)`

`BOOKING(BookingID, BookingDate, CustomerID)`

`SESSION(SessionID, Date, Time, SessionCost)`

`BOOKING_SESSION(BookingID, SessionID, Quantity)`

CustomerID is the unique identifier in the CUSTOMER table.

BookingID is the unique identifier in the BOOKING table.

SessionID is the unique identifier in the SESSION table.

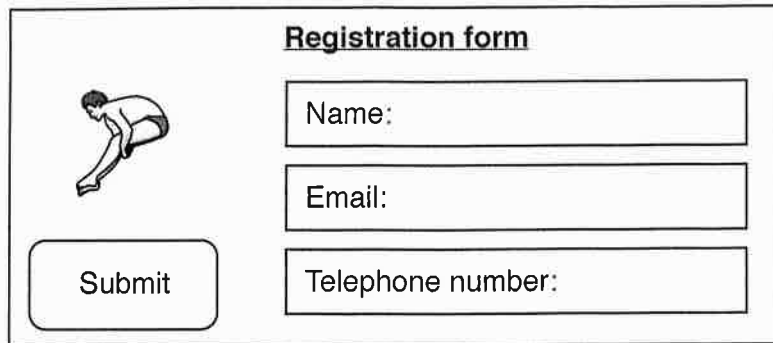
- (i) Draw an Entity-Relationship (E-R) diagram to represent this data model. [4]

- (ii) Name the fields that would be used to calculate the customer's payment for a session. [2]



- (c) Before customers can make an online ticket purchase, they have to fill in a registration form.

The details from this form are used to complete the `CUSTOMER` table.



The diagram shows a registration form titled "Registration form". On the left side, there is an illustration of a person in a starting crouch and a rounded rectangular button labeled "Submit". On the right side, there are three rectangular input fields stacked vertically, labeled "Name:", "Email:", and "Telephone number:".

Explain how the web server will use server-side script to process this form.

[5]

- (d) The organisers of the championship store all the data for the event using cloud storage.

Describe **three** economic benefits to the organisers of using cloud-based storage.

[3]

