



National
Qualifications
2020-2021

CS(AH)21

Computing Science

Duration 2 hours 30 minutes

Total marks – 70

SECTION 1 – 15 marks
Attempt ALL questions.

SECTION 2 – 55 marks
Attempt ALL questions.

You may use a calculator.

Write your answers clearly in the answer booklet provided. In the answer booklet you must clearly identify the question number you are attempting.

Use blue or black ink.

Before leaving the examination room you must give your answer booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

SECTION 1 - Attempt all questions

MARKS

1. Object-oriented languages have a number of key features.

- (a) Describe the use of a constructor in object-oriented programming. 1
- (b) State the feature of object-oriented languages that requires that methods are used to access instance variables rather than directly accessing the instance variables themselves. 1

2. A web site is available for a range of devices. It uses the following CSS code.

```
body {
    background-color: black;
}

@media screen and (max-width: 992px) {
    body {
        background-color: grey;
    }
}

@media screen and (max-width: 600px) {
    body {
        background-color: white;
    }
}
```

Explain the purpose of this code. 2

3. A database is held on a server with the following access details.

Server: db.myrental.com
 Username: dbsecure
 Password: cloud812
 Database Name: myrentaldb

- (a) Write the PHP code to connect to this database. 2
- (b) Write the PHP code to terminate the connection to this database. 1

4. Some sample data for a table from a database is shown below.

Clown		
ClownNo	ClownType	LocationID
DD291	Tramp	209
YU913	Mime	102
NT1716	Jester	585
WW212	Rodeo	662

The primary key is **ClownNo** and **LocationID** is a foreign key from a table called Location.

Write the SQL statement to create the **Clown** table. 4

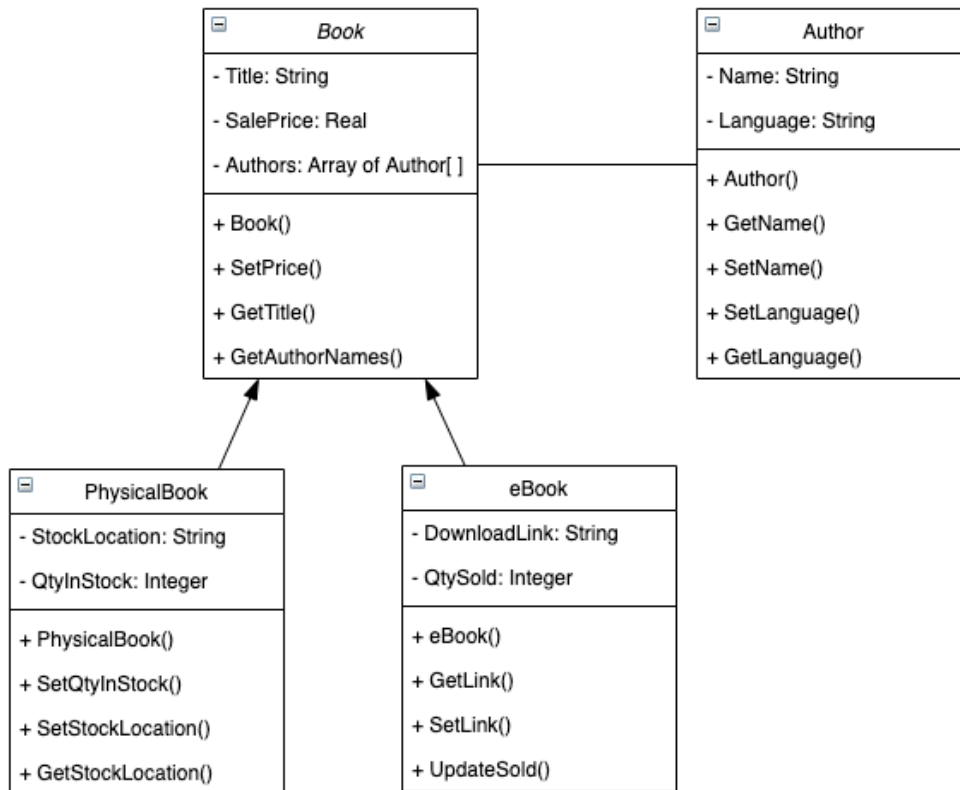
5. During the development of mobile computer game, the developers make use of integrative testing. Describe the purpose of integrative testing. 2
6. An online service is built using PHP and HTML.
- When users access the online service web site a PHP session begins.
- (a) Describe the purpose of the PHP session. 1
- (b) State the command used to begin the session. 1

Section 2 - Attempt ALL questions

MARKS

7. A book shop has developed an app, using an object-oriented programming language, to track details of books that they stock.

A simplified version of the UML class diagram and code for the Book class is shown below.



```

Line 01 CLASS Book IS { STRING Title, REAL SalePrice, ARRAY OF Author Authors[] }
Line 02 METHODS
Line 03     CONSTRUCTOR (STRING Title, REAL SalePrice, ARRAY OF Author Authors[] )
Line 04         DECLARE THIS.Title INITIALLY Title
Line 05         DECLARE THIS.SalePrice INITIALLY SalePrice
Line 06         DECLARE THIS.Authors[] INITIALLY Authors[ ]
Line 07     END CONSTRUCTOR

Line 08     PROCEDURE SetPrice(REAL SalePrice)
Line 09         SET THIS.SalePrice TO SalePrice
Line 10     END PROCEDURE

Line 11     FUNCTION GetTitle()
Line 12         RETURN THIS.Title
Line 13     END FUNCTION

Line 14     FUNCTION GetAuthorNames() {
Line 15         DECLARE AuthorString AS STRING INITIALLY ""
Line 16         DECLARE AuthName AS STRING INITIALLY ""
Line 17         FOR EACH Author IN THIS.Authors[ ] DO
Line 18             SET AuthName TO Author.GetName()
Line 19             SET AuthorString TO AuthorString & AuthName
Line 20         END FOR
Line 21         RETURN AuthorString
Line 22     END FUNCTION
Line 23 END CLASS
    
```

7. (continued)

MARKS

(a) Using a programming language of your choice, write the code equivalent to Line 1 of the Book class, for the declaration of the eBook class.

2

(b) Information about a physical book to be added to the app is shown below.

Title: Open Security SalePrice: 12.99
Authors:
 Name: Chiyo Abad Language: English
 Name: Sai Rishi Language: Urdu
StockLocation: Row C
QtyInStock: 5

Using a programming language of your choice:

(i) Write code to create an array of authors using the values provided.

3

(ii) Use your array of authors from (i) to instantiate an object using the PhysicalBook class.

2

(c) (i) A total value for sales of an eBook is required so the eBook class is updated with a new method calculateSales().

```
Line 151      FUNCTION calculateSales()  
Line 152                      <salesTotal is QtySold * SalePrice>  
Line 153                      RETURN salesTotal  
Line 154      END FUNCTION
```

Using a programming language of your choice, write the code for line 152.

1

(ii) The following line of code creates an array of 50 eBooks.

```
DECLARE eBooksSold AS ARRAY OF eBooks INITIALLY <array of 50  
eBook objects>
```

The store is interested in the total eBook sales value for all books with an English language author.

Using a programming language of your choice, write the code used to calculate the total sales value for all eBooks where at least one author has a language of English.

4

8. A TV Talent Show uses an audition management system which allows Assistants and Directors to register contestants, view and edit contestant personal details. Directors can also export statistics about contestants. Judges can also view and edit personal details and audition records. Directors and Judges can generate reports and Judges can also setup callback auditions with contestants.

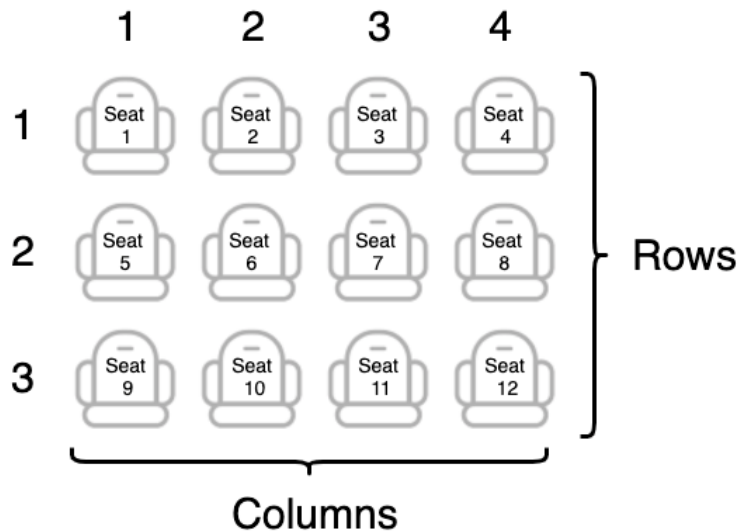
(a) With reference to the information above, draw a use case diagram to represent the requirements of the audition management system. 4

(b) There are twelve seats in the semi-final of the TV Talent Show. As contestants are given scores out of 100, they fill the seats. Once all the seats are filled, the next contestant's score is compared with the lowest contestant in the seats. If the next contestant has a higher score, they replace the contestant with the lowest score, by taking their seat.

The audition management system uses a record structure to hold the information about each contestant on a seat. The information stored about each contestant is:

Details stored	Sample data
Name	Harry Malik
Parent Present	TRUE
Semi-Final Score	54
Seat Number	7

The seats are laid out as follows in the TV studio.



(i) Using a programming language of your choice, define a record structure to store the details for a contestant. 1

(ii) Using a programming language of your choice, declare a 2-D array called ContestantSeating to store the details of contestants. 1

(iii) The twelve elements of the ContestantSeating 2-D array are initialised with the values "No Contestant", false, 0 and 0.

Using pseudocode, design a sub-routine to initialise the variable ContestantSeating with the appropriate values. 2

8. (continued)

MARKS

- (c) Once all 12 seats are filled, each time a contestant is compared with the seated group of contestants an insertion sort is used to sort the scores and identify the seat number of the lowest scoring contestant.

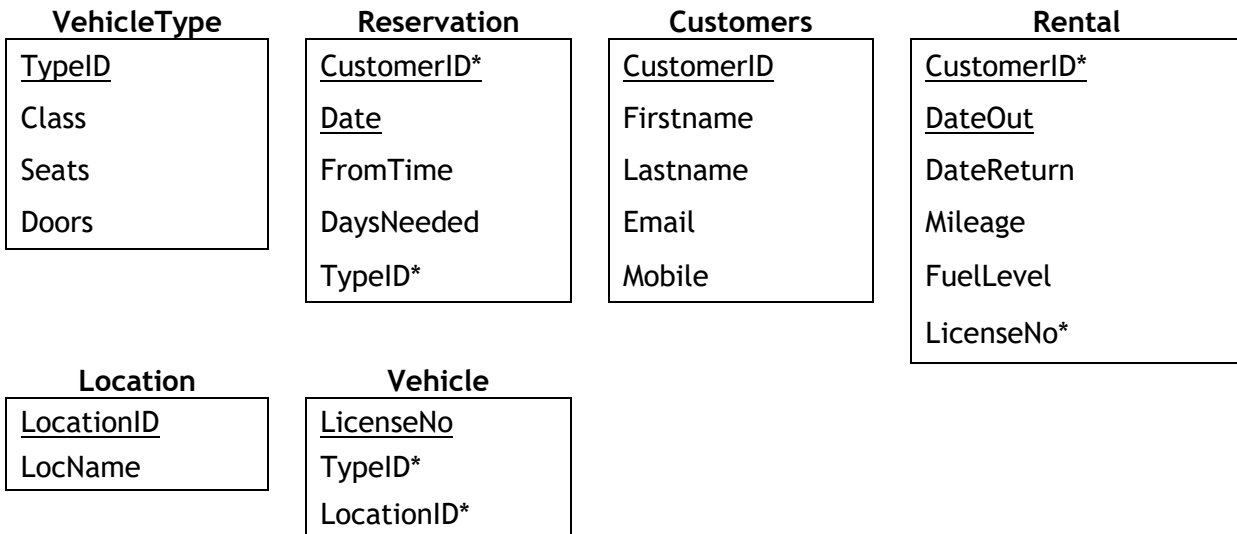
A function, called `LowSeat`, is used to return the seat number of the contestant with the lowest score. For input, the function receives two parallel 1D arrays; one of scores and one of seat numbers (both generated from the 2D array for the seated contestants) e.g.

Index	0	1	2	3	4	5	6	7	8	9	10	11
Score	47	58	82	49	61	60	92	87	85	76	62	63
SeatNumber	11	1	3	10	4	5	6	7	8	9	3	2

The function makes use of the Insertion sort to sort both arrays in to ascending order of Score.

- (i) Explain how the insertion sort algorithm would be used to place the value, 49, in the correct position in the Score array. 3
- (ii) Using pseudocode, write a solution for this function that will return the SeatNumber for the contestant with the lowest score. 5
- (iii) Explain why it may have been more effective to use bubble sort than insertion sort for this function. 2

9. An online service is designed for a car rental company. The system is designed with the following entities and attributes.



Customers make a reservation for a type of vehicle which they will pick up from and return to a location. Customers cannot make more than one reservation for the same date. When the customer arrives at the location, they are allocated a car of the required type. When the car is returned, the mileage the car has travelled and the amount of fuel in the tank is recorded as well as the date the car is returned.

- (a) Draw an entity relationship diagram for this system. Show strong and weak entities and the participation between the entities. You do not need to include attributes in your diagram.
- (b) Customers need to know which types of vehicles are at each location. The customer will see the following information.

LocName: Dollar Class: Roaster
 Seats: 2 Doors: 2
 At location: 7

Write the SQL statement to display the number of vehicles, of each VehicleType, at this location.

5

3

10. A pizza delivery company allows orders to be placed online.

Orders are submitted via a form and processed securely by a server-side script called `orders.php`. The form begins with the HTML below.

`<form _____ >`

- (a) Complete the form element of the HTML code used to create this form. 2
- (b) Some of the remaining HTML for this form is shown below.

```

Line 10      Name: <input type=text name="name" required />
Line 11      Contact Number <input type=text name="contactno" required />
Line 12      Address: <textarea name=address required></textarea>
Line 13      Delivery Time: <input type=text name="deliverytime" required />
Line 14      Meal Bundle:<select name="mealbundle">
Line 15                <option>Please Select</option>
Line 16                <option value="Meal For Two">Meal for
Line 17                Two</option>
Line 18                <option value="Family Feast">Family
Line 19                Feast</option>
Line 20                <option value="Mega Pizza">Mega Pizza</option>
Line 21                </select>
Line 22      <input type=submit value="Submit"/>

```

The information returned from this form is used in the following INSERT statement to update the database.

```

INSERT INTO Order (Name, ContactNo, Address, DelTime, MealBundle)
VALUES (_____ )

```

Write the PHP code to process the values returned by this form and execute the query shown with these values. Assume the connection to the database is already open via the `$conn` link.

4

10. (continued)

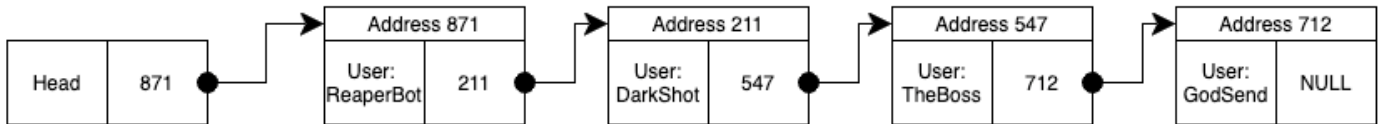
- (c) Early in the development progress, the development team completed usability testing using the following prototypes.

Explain how usability testing of these prototypes would support the development of the pizza order system.

3

- (d) When the web site is very busy, users are placed in a queue before they can access the site.

A linked list is used to manage users who are waiting to gain access to the pizza delivery system.



- (i) Describe the changes that will be made to the linked list when the node at the head of the list leaves the list to access the webserver.

2

- (ii) A new user attempts to access the site but is added to the end of the list.

User: RoroBear
Address: 513

Explain what must happen to add this user.

2

- (e) (i) The pizza delivery company want to launch a “Gold” service, where users, in any position, can pay a fee to jump up to 5 spaces closer to accessing the web site at busy times.

Explain why this cannot be implemented with the current data structure.

2

- (ii) Describe a solution, using a linked list, to the problem identified in (i).

2

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