**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Class:** \_\_\_\_\_\_\_\_\_\_\_\_\_



###### **JURONG PIONEER JUNIOR COLLEGE**

**JC2 Preliminary Examination 2019**

**COMPUTING 9597/02**

**Higher 2**  **18 September 2019**

Paper 2 (Written) **3 hours**

Additional materials: Answer Paper

Cover Page

**READ THESE INSTRUCTIONS FIRST**

Answer papers will be provided with the question paper.  
Write your name and civics class on all the work you hand in.

Write in dark blue or black pen on both sides of the paper.

You may use a HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Answer **all** the questions.

Approved calculators are allowed.

You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The total number of marks for this paper is **120**.

This document consists of **11** printed pages and **1** blank page

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| **1** | Furniture retailer XFurniture is currently using a manual, paper-based ordering system.  The customer visits the show room and informs the salesperson his/her furniture selection. After which, the salesperson asks the filing clerk to locate the relevant paper files that contain all the necessary details of the chosen item in the file cabinet. The files contain the following information of a furniture item:   * item code * description of item * price of item * delivery time * details of the supplier   The customer pays for the purchase and the salesperson hands the original purchase order, and a duplicate copy to the customer and the filing clerk respectively. At the end of the day, the filing clerk will record the total sales for the day and proceed to order the furniture from the supplier by sending them a purchase order of the consolidated furniture items sold for the day.  The management of XFurniture decides to replace its current system with a server–based ordering system.  A system developer from an IT consultant firm is employed to carry out the project. The first task is to write a project proposal. |  |
|  | 1. One section of the project proposal is the Problem Statement which lists the problems in the current system. Write the Problem Statement. | [4] |
|  | The system developer draws up a list of activities that will be required for the completion of the software project:   |  |  |  | | --- | --- | --- | | **Identifier** | **Activity** | **Estimated duration (weeks)** | | A | Order and deliver the new database system and server | 4 | | B | Design and install the network infrastructure | 7 | | C | Order, deliver and install new PCs and printer | 9 | | D | Test the database system, server and network | 3 | | E | Test the PCs with the server and network | 2 | | F | Copy existing sales data to the new database system | 1 | | G | Copy other existing PC software to the new PCs | 3 | | H | Test all software and database on the new PCs and server | 1 | | I | Train users | 2 |   Tasks A, B and C can be undertaken at the same time, but Task A and Task B must be completed before Task D can commence. Tasks C and D must be completed before Task E can begin. Task E must be completed before Tasks F and G can start. Tasks F and G can be undertaken at the same time, but both must be completed before Task H can commence. Task I must follow Task H. |  |
|  | 1. Draw a PERT chart for this project. Provide a node key explaining the layout and contents of the nodes used in your diagram. | [4] |
|  | 1. Copy and complete the following table with the earliest and latest start times, the earliest and latest finish times, duration, and float time for each task.  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Task** | **EST** | **LST** | **EFT** | **LFT** | **Duration** | **Float** | | A | 0 | 3 | 4 | 7 | 4 | 3 | | B |  |  |  |  | 7 |  | | C |  |  |  |  | 9 |  | | D |  |  |  |  | 3 |  | | E |  |  |  |  | 2 |  | | F | 12 | 14 | 13 | 15 | 1 |  | | G |  |  |  |  | 3 |  | | H | 15 | 15 | 16 | 16 | 1 |  | | I | 16 | 16 | 18 | 18 | 2 | 0 | | [4] |
|  | 1. State the critical path. | [1] |
|  | 1. State the minimum time required for the project to be completed. | [1] |
|  | 1. Dummy task may be used in PERT chart. What is a dummy task? | [1] |
|  | 1. Draw a Gantt chart for the same project tasks, showing each of these tasks, all dependencies, and the duration of each task. Highlight the critical path on the Gantt chart. | [4] |
| **2** | A project’s software development life cycle includes analysis, design, development, testing, implementation, and evaluation stages. |  |
|  | 1. Describe the following testing strategies that might be carried out during a software development project, and explain how each type of the testing strategy contributes to the overall quality of the project’s deliverables. |  |
|  | 1. Bottom-up testing. |  |
|  | 1. Top-down testing. | [6] |
|  | 1. State **two** methods that could be used to implement a newly developed system. Give a reason for each of the method chosen. | [4] |
| **3** | 1. **Copy** and **complete** the algorithm for a binary search written in pseudocode shown below. It is given that the data being searched is stored in the array SearchData[63], and the item of data being searched is stored in the variable SearchItem.   X ←0  Low ← 1  High………………………………………  WHILE (High >= Low) AND (…………………………………………………)  Middle ← INT((High + Low)/2)  IF SearchData[Middle] = SearchItem  THEN  X ← Middle  ELSE  IF SearchData[Middle] < SearchItem  THEN  Low ← Middle + 1  ELSE  IF SearchData[Middle] > SearchItem  THEN  …………………………………………  ENDIF  ENDIF  ENDIF  ENDWHILE | [3] |
|  | 1. State the maximum number of comparisons that are required to find an item which is present in SearchData. | [1] |
|  | 1. You will change the binary search algorithm to a recursive algorithm and write the equivalent program code in the form of a procedure. Name the recursive procedure BinarySearch. Use the following variables:  |  |  |  | | --- | --- | --- | | **Variable** | **Data Type** | **Description** | | SearchData | ARRAY[63] : INTEGER | global array | | SearchItem | INTEGER | global variable | | X | INTEGER | global variable | | Low | INTEGER | parameter | | High | INTEGER | global variable | | Middle | INTEGER | local variable |   Write pseudocode or program code for the recursive procedure BinarySearch. | [4] |
| **4** | Object-oriented programming is used to store and process data for a company’s payroll. |  |
|  | 1. With reference to the class diagram shown above, explain: |  |
|  | 1. data encapsulation, and how classes support information hiding and implementation independence. | [3] |
|  | 1. inheritance, and how it promotes software reusability. | [2] |
| **5** | With reference to **Question 1**, a server–based ordering system will be implemented in XFurniture.  Local Area Network (LAN) will be used for the staff and customers. |  |
|  | 1. Explain the meaning of a protocol for communication within the LAN. | [1] |
|  | 1. State the purposes of switches and routers in a network. | [4] |
|  | 1. Explain the differences between using packet switching and circuit switching in the transmission of a message. | [3] |
|  | 1. The LAN is connected to the Internet. Discuss the social and ethical effects of allowing staff to have unrestricted access to the Internet. | [4] |
|  | 1. Customers are now able to order furniture online after logging in to the XFurniture online system. |  |
|  | 1. Explain why authentication techniques are necessary. | [2] |
|  | 1. Explain **two** methods for ensuring security of a network application. | [2] |
|  | 1. A security policy is a formalised statement that defines how security will be implemented within XFurniture. Explain why staff members are required to know the need for privacy and integrity of data. | [2] |
|  | 1. Explain why XFurniture has chosen to implement their server–based ordering system over the intranet. | [4] |
|  | 1. An alternative to a server–based ordering system is to subscribe the services of cloud computing. State the **three** services provided by cloud computing, and explain how they can benefit XFurniture. | [6] |

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| **6** | A reservation form used for booking JP Hotel rooms is shown:    There are three room types available and the room rates are higher for arrival on Fridays and Saturdays. |  |
|  | A normalised database solution is designed to store data for the hotel using a number of tables. |  |
|  | 1. Draw an E-R diagram that shows these tables and the relationships between them. | [4] |
|  | 1. Using standard notation, write the table descriptions of the tables in part **(a)**. | [6] |
|  |  |  |
|  | To book a room in JP Hotel, the guest can fill in the hotel reservation form with details specified on the form. After the form is submitted, the credit card number and its expiration date are validated. The guest will be notified with a message if the credit card number is invalid. If the credit card number is valid, details of the guests will be stored in a file. The room type requested by the guest will then be checked for availability. If room type requested by guest is available, a confirmation letter will be sent to the guest. |  |
|  | 1. Draw a data flow diagram for the hotel reservation system. | [8] |
|  | 1. A hotel room accommodates two guests and also includes breakfast for two. The hotel allows for an additional guest to stay in a room booked for two guests at a charge of $80. An extra bed may be requested for the additional guest at a charge of $20. Breakfast can also be provided for the additional guest at $20. |  |
|  | 1. Create a decision table showing all the possible conditions and actions. | [4] |
|  | 1. Simplify your decision table by removing redundancies. | [2] |
|  |  |  |
| **7** | 1. Computers use character codes that can be represented by ASCII and Unicode. Explain the differences between these two character encoding systems. | [2] |
|  | 1. Given that **two** bytes are used to represent a positive integer, what is the denary number that corresponds to the **two** successive bytes below?   10010101 00110011 | [2] |
|  | 1. What is the hexadecimal number of the **two** bytes in **(b)**? | [2] |
| **8** | An Abstract Data Type (ADT) is a type (or class) for objects whose behavior is defined by a set of value and a set of operations.  A linked list ADT has the following operations defined:   1. **Create(x)** – creates an empty linked list **x**. 2. **Insert(x,item,i)** – inserts new value, **item**, into linked list **x** so that it is at position **i** in the linked list. 3. **Delete(x,i)** – deletes the **item** at position **i** in the linked list **x**. 4. **Read(x,i)** – returns the **item** at position **i** in the linked list **x**. 5. **Length(x)** – returns the number of items in the linked list **x**. 6. **IsEmptyList(x)** – returns true if linked list **x** is empty.   The linked list is implemented by the use of a collection of nodes that has **two** parts: the **data** and a **pointer to the next item** in the linked list. In addition, there is a **Start** pointer which points to the first node in the list. |  |
|  | 1. Assume a node with the following structure:     Complete the algorithm to implement the 'Delete' operation: | [5] |
|  | PROCEDURE Delete (x, i)  IF Length(x) = 0 THEN  ....................................  ENDIF  IF i = 1 THEN // situation 1: delete the 1st node  temp 🡨 Start  ....................................  ELSE // situation 2 : delete middle node  Previous = NULL  Current = Start  FOR n = 1 TO (i – 1) STEP 1  ....................................  ....................................  NEXT n  .................................... // make the deletion  ENDIF  ENDPROCEDURE |  |
|  | 1. Show how the following operations for an ADT called QUEUE using the linked list ADT operations can be implemented. 2. Create new queue. 3. Add item to a queue. 4. Delete item from a queue. | [1]  [2]  [2] |
| **9** | A binary search tree is stored as an array of records. Each record represents a node and consists of the data and a left pointer and a right pointer. After a number of records are inserted, the tree is as shown.  The array is called BinaryTree.  The notation BinaryTree[Root].Data will access the data at root node. |  |
|  | BinaryTree   |  |  |  |  | | --- | --- | --- | --- | |  | LeftPtr | Data | RightPtr | | [1] | 2 | Jay | 3 | | [2] | 4 | Gel | 0 | | [3] | 0 | Ken | 5 | | [4] | 0 | Ace | 0 | | [5] | 6 | Pan | 0 | | [6] | 0 | Max | 0 | | [7] | 8 |  |  | | [8] | 9 |  |  | | [9] | 0 |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Root | 1 |  | NextFree | 7 | |  |
|  | 1. Draw the binary search tree. | [2] |
|  | 1. Complete the algorithm to find a node in a binary search tree. This function will return a pointer to node. | [4] |
|  | FUNCTION FindNode(SearchItem) RETURNS INTEGER  TempPtr ← Root  WHILE TempPtr <> NULL AND ............  IF ............ THEN  TempPtr ← BinaryTree[TempPtr].LeftPtr  ELSE  ............  ENDIF  ENDWHILE  ............  ENDFUNCTION |  |
|  | 1. Write an algorithm for a pre-order traversal of the binary search tree. | [4] |

**END OF PAPER**