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|  | **RIVER VALLEY HIGH SCHOOL**  **YEAR 6 PRELIMARY EXAMINATION** |

**H2 COMPUTING 9597**

**Paper 2**

20 SEP 2019

**3 Hours**

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| --- | --- |
| **NAME** |  |
| **CLASS** | 18J ( 06 ) |
| **INDEX NO.** |  |

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| **Instructions to candidates**  **DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.**  **Read these notes carefully.**  *Write your name, class and index number above*. | | | |
| *Answer* ***all*** *questions on foolscap. There are 9 questions in total.*  *Approved calculators are allowed.* |  | **FOR EXAMINERS’ USE** | |
| **1** | **/10** |
| **2** | **/7** |
| **3** | **/8** |
| **4** | **/5** |
| **5** | **/10** |
| **6** | **/10** |
| **7** | **/11** |
| **8** | **/28** |
| **9** | **/11** |
| **TOTAL** | **/100** |
|  | |

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

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This Question Paper consists of 9 printed pages.

1. Vending machine
2. Draw a data flow diagram for a vending machine system that allows user to buy drinks using coins and seller to refill stock. *Note: You are to decide on the processes to be included in the DFD on your own.* [5]
3. Draw a flow chart on the steps in dispensing a drink by the vending machine. Your flow chart should include various situations faced by the system e.g. not enough cash, drinks chosen out of stock etc. [5]
4. Driverless car
5. State one ethical and one social issue of using driverless car. [2]
6. A simplified decision making on the behavior of a driverless car is as follow.
   * When a pedestrian is sensed 10m ahead, the driverless car **must** apply emergency break if its current speed is more than 20 km/hr. Otherwise, it should slow down gently.
   * In other situations, when red light is sensed 20m ahead, the driverless car should slow down gently regardless of its speed.

Draw a reduced decision table for the scenario above. [5]

1. A project manager uses the PERT chart to manage a software project.

A (4)

F (9)

C (7)

B (5)

D (3)

E (3)

G (2)

|  |  |  |
| --- | --- | --- |
| **Activity** | **Description** | **Duration (week)** |
| A | Specification | 4 |
| B | Installation of datastore servers | 5 |
| C | Development | 7 |
| D | Unit Testing | 3 |
| E | System testing | 3 |
| F | Conversion of existing data files to new format | 9 |
| G | UAT | 2 |

1. Explain the significance of the dotted line. [1]
2. Draw a Gantt chart based on the above information. [3]
3. State the impact on the project if activity F duration is cut by 3 weeks. [2]
4. State the purpose of the project proposal. [1]
5. State 2 important topics in the project proposal. [1]
6. A user-defined linked list has the following operations.

|  |  |
| --- | --- |
| Operations | Description |
| create() | This function creates an empty linked list.  For example:  lst1 = create()  A linked list is created and referenced by lst1. |
| insert(llst,data) | This procedure always adds data as a node at the head of the linked list  For example  lst1: 'A'->'B'->'C'->'D'->'E'  insert(lst1, 'Z')  lst1: 'Z'->'A'->'B'->'C'->'D'->'E' |
| split(llst,pos) | The function breaks the linked list at position pos and returns the cut half as a new linked list.  For example:  lst1: 'A'->'B'->'C'->'D'->'E'  lst2 = split(lst1, 2)  lst1: 'A'->'B'  lst2: 'C'->'D'->'E' |
| join(llst1,llist2) | This function joins 2 linked lists as one.  For example:  lst1: 'C'->'B'  lst2: 'A'->'D'->'E  join(lst1, lst2)  lst1: 'C'->'B'->'A'->'D'->'E'  lst2: Empty |

Using the provided operations of the linked list, write, in pseudo-code an algorithm that could be used to implement the swap operation. *Hint: you don’t have to use all the operations provided.*

|  |  |
| --- | --- |
| Operations | Description |
| swap(llst,pos) | This procedure swaps the data at positions pos and pos + 1  For example:  lst1:'A'->'B'->'C'->'D'->'E'  swap(lst1,3)  lst1:'A'->'B'->'D'->'C'->'E' |

You can assume that the operations executed are always valid. For example, if there is no 5th node, swap(lst1,4) will not be called. [5]

1. Computer Network
2. Explain how the switch forwards data packet to destinated device. [1]
3. State the function of a router. [1]
4. Explain with an example what a client server network is. [1]
5. Describe the differences between PaaS and IaaS. [1]
6. State 2 data verification methods. [1]
7. Explain what packet switching is. [1]
8. State the connection mode that the walkie-talkie (push to talk) is working on. [1]
9. State the difference between synchronous and asynchronous data transmission. [1]
10. State and explain a method to protect data in transit. [1]
11. State and explain a method to protect data at rest. [1]
12. A sort procedure is implemented in Python is follow.

def sort(sort\_lst, unsort\_lst):

if len(unsort\_lst) > 0:

item = unsort\_lst[0]

i = 0

while i < len(sort\_lst) and item < sort\_lst[i]:

i += 1

return sort(sort\_lst[:i]+[item,]+sort\_lst[i:], unsort\_lst[1:])

else:

return sort\_lst

1. State the name of the above sorting algorithm. [1]
2. The below statement is executed.

>>> sort([], [9,1,8,2,3,7,5])

Using the table below, trace the items in sort\_lst and unsort\_lst in each recursive call.

|  |  |  |
| --- | --- | --- |
| **#** | **sort\_lst** | **unsort\_lst** |
| 1 | [] | [9,1,8,2,3,7,5] |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |
| 8 |  |  |

[3]

1. State the time complexity of the sort procedure above. [1]

A sleepy teacher implemented an inefficient binary search function as follow. The function is supposed to return True if target is found in the list inc\_sort\_lst and False otherwise.

01 def binSearch(target, inc\_sort\_lst):

02 if len(inc\_sort\_lst) == 0:

03 return False

04 if len(inc\_sort\_lst) == 1:

05 return True

06 n = len(inc\_sort\_lst)

07 first\_half = inc\_sort\_lst[:n//2]

08 second\_half = inc\_sort\_lst[n//2:]

09 if target > first\_half[-1]:

10 return binSearch(target, second\_half)

11 else:

12 return binSearch(target, first\_half)

1. Explain the bug in his code with examples. [1]
2. Explain how you can correct the bug without changing the code from line 06 onwards. [2]
3. Explain why the binary search performed is inefficient. [2]
4. Run length encoding (RLE) is a very simple form of lossless data compression which runs on sequences having same value occurring many consecutive times and it encodes the sequence to store only a single value and its count. For example, “111111000” can be converted to “6130”.

Below is a draft attempt of implementing this algorithm.

01 PROCEDURE RLECompress(s: STRING):

02 DECLARE comp\_str: STRING

03 DECLARE count, i: INT

04 comp\_str = ""

05 count, i = 0, 0

06

07 WHILE i < LENGTH(s):

08 count = 1

09

10 WHILE i < LENGTH(s) - 1 and s[i] == s[i+1]:

11 count += 1

12 i += 1

13 END WHILE

14

15 comp\_str += count + s[i]

16 END WHILE

17

18 RETURN comp\_str

19 END PROCEDURE

1. The compiler reported an error at line 15. Identity the type of error, state its definition and suggest how it can be fixed. [3]
2. After the above error has been corrected, a successful compilation produces executable code. However, when the code was executed, it failed to complete. Identity another type of error, state its definition and suggest how it can be fixed. [3]

Assuming all errors have been identified and corrected.

The following steps are taken to encode English alphabets:

* 1. Convert alphabet to hexadecimal ASCII value
  2. Convert the hexadecimal number to binary number
  3. Encode the binary number using RLE algorithm

For example, the alphabet “A” has a hexadecimal ASCII value of “41”.

1. State the definition of ASCII. [2]
2. State the encoded RLE string for letter “A”. [1]
3. State and explain with example one potential limitation of RLE encoding when compressing long binary strings. [2]
4. The school library currently stores their data in flat files. These files contain information about students, books and their loaning details.

Using examples from the school’s flat files to illustrate your answers.

1. Explain how data inconsistency could arise. [2]
2. Explain why data privacy could be a potential concern. [2]
3. Explain the definition of Primary Key in a relational database. [2]

A book can be borrowed by any student, and a student can borrow any book. Students need to fill up a loaning record form each time he/she wants to borrow a book. A student is entitled to borrow up to 5 books each time using the same loaning record form.

The decision has been made to create a relational database for the library loaning system.

1. Identify the necessary tables and draw an E-R diagram to show the relationships between these tables. [4]
2. For each table specify the attributes (fields) required and state suitable primary keys and foreign key relationships. State necessary legends if you are using symbols to represent the primary and foreign keys. [7]

The following table is generated for students’ reference regarding their loaning details.

|  |  |  |  |
| --- | --- | --- | --- |
| **Student Name:** | Xiao Ming | **Class:** | 19J08 |
|  | | | |
| **Book Name** | **Author** | **Loan Date** | **Due Date** |
| A Brief History of Time | Stephen Hawking | 05 Aug 2019 | 30 Aug 2019 |
| Spider Man Comics | Stan Lee | 29 Aug 2019 | 20 Sep 2019 |

1. To create the report StudentName and StudentClass are used. Name other fields that the database uses to produce this report. [4]

Beside the database design, you are also in charge of creating an online loaning form.

1. Design and draw a webpage layout for the auto loaning interface for the new system. Identify and briefly explain your design considerations for the various features which aid users to input valid data entries. [4]
2. Some students use their handphones to snap photos of tables and charts from the books they borrowed and use them for their research projects. Explain what potential issues may arise and suggest alternate ways which students can adopt. [3]
3. The school library has in store different kinds of items which students can loan out. Information about items are stored and recorded, such as title, description, and damaged, which is a Boolean value indicating if the item has any form of physical damage.

For books in the library, additional information such as the author, publisher, ISBN are recorded.

Digital media resources are also available for students’ reference. Information such as storage media, file size and playback time are stored.

You are engaged by the school to design an Object-Oriented Programming solution to manage these items.

1. Draw a class diagram, with base class Item, showing:

* appropriate sub-classes
* inheritance
* the properties required
* appropriate methods, including **constructor** methods, and at least **one** pair of **‘get’** and **‘set’** methods for one of the properties.

[5]

1. Using the above example, explain the meaning of the term **Polymorphism**. [2]
2. Using the above example, explain the meaning of the term **Encapsulation**. [2]
3. The school also provides a series of past year examination papers for the students’ loaning and reference. State how this would affect the **class**, **properties** and **methods** in the current example. [2]