RIVER VALLEY HIGH SCHOOL
YEAR 6 PRELIMARY EXAMINATION

H2 COMPUTING 9597
Paper 2
13 SEPT 2018

3 HOURS

NAME _____

CLASS 6 ( )

INDEX NO. _____

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	/4
2	/4
3	/4
4	/3
5	/18
6	/15
7	/7
8	/5
9	/40
TOTAL	/100

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

This Question Paper consists of **8** printed pages.

1. The number is divisible by 11 if the difference between the sum of digits in the odd positions and the sum of digits in the even positions is divisible by 11. The recursive function returns `True` if `n` is divisible by 11 and `False` otherwise.

```
def divisible_by_11(n):
    def helper(n, total, toggle):
        if n == 0:
            return ____A____
        elif toggle:
            return helper(n//10, ____B____ , False)
        else:
            return helper(n//10, ____C____ , True)
    return helper(n, 0, True)
```

a) State the code for A, B and C. [3]

b) State the time complexity of the function in Big O notation. [1]

2. The function `sort` is shown below.

```
def sort(lst):
    if len(lst)<=1:
        return lst
    else:
        pivot = lst[0]
        smaller = []
        larger = []
        for i in range (1, len(lst)):
            if lst[i] <= pivot:
                smaller.append(lst[i])
            if lst[i] > pivot:
                larger.append(lst[i])
        combined = sort(smaller) + [pivot,] + sort(larger)
        print(combined)
        return combined
```

a) State the name of the sorting algorithm. [1]

b) State the output of the print statement when the following is executed.

```
>>> lst = ['2','5','3','6','1','4']
>>> sort(lst)
```

[3]

3. Below shows a fixed set of hash keys.
`[3, 12, 234, 55, 76, 12441, 377, 1228, 339, 3216]`

a) Create a perfect hash function for the keys above. [2]

b) Illustrate 2 properties of a good hash function with examples. [2]

4. An example of a small local supermarket inventory record consists of 5 fields <product number>, <manufacture date>, <expiry date>, <product name>, <quantity> is as follow:

- 1002 (INTEGER ranges from 0 - 99999)
- 12 JUNE 2018 (STRING OF CHARACTERS)
- 12 DECEMBER 2018 (STRING OF CHARACTERS)
- MILK MARIGOLD ONE LITRE (STRING OF ALPHABETICAL CHARACTERS)
- 20 (INTEGER ranges from 0 - 1000)

Using the example above, suggest a way in which the fields of the record can be organized such that a smaller file size is used. [3]

5. The Friendly Neighborhood Clinic (FNC) is shifting is service from hard copy to a relational database management system. A typical Patient Record Form can be found below.

The manager of the clinic told you that there are several doctors taking shifts to serve the patients, they could be identified by their staff ID. Not all patients need a medical certificate (MC). Patient Record Number, MC Tracking Number and Medicine Serial Number are unique values to identify patient records, MC records and Medicines.

Patient Record Form				
Patient Record No:		**Appointment Date:**		
Patient Name:		**NRIC:**		
Address:				
Doctor Name:		**Staff ID:**		
Specialization:		**Contact:**		
Medical Certificate:	Yes/No	**MC Tracking No:**		
Start Date:		**End Date:**		
Medicine Serial No	**Description**	**Symptom**	**Unit Price**	**Quantity**

a) You are required to design a relational database solution for the clinic. Identify the tables that will give a normalized solution. Show the process of normalization. [6]

b) Based on your solution in (a), draw a fully labelled ER diagram to show how the entities are related. [4]

c) The clinic also needs to constantly stock up medicines from various medicine companies. One order from the same company could comprise of multiple medicines produced by that company.

On top of the tables stated in your solution in (a), suggest meaningful relational database tables. Give the table descriptions including the table and attribute names. Ensure there are at least 1 attribute in addition to the primary key. [4]

d) Explain the term "primary key" and "foreign key" by quoting examples in this question. [4]

6. You are tasked to design a queue management system for the FNC clinic. Each queue should contain the queue number, patient NRIC, current date and queue time.

The clinic provides various forms of services such as doctor appointment or health checkup.

If it is a doctor appointment, additional information such as a list of past medical records within the clinic needs to be added for doctor's easy reference.

Each Medical Record should contain the patient NRIC, date of visit, doctor remarks and medicine purchase record.

If it is a health checkup, additional information such as checkup stations and report collection date need to be included.

a) Draw a UML class diagram that shows how the properties could be distributed amongst the classes. Include in your diagram any inheritance between the classes. Also indicate some of the methods that would be required. Circle one method which demonstrates polymorphism. [6]

b) Some patients may have special needs such as the elderlies. Hence some patient may be granted a priority in queueing. Explain how this affects the **classes**, **properties** and **methods** given in (a). [3]

c) Using the above example, explain the concept of a **class** and an **instance** of the class in object-oriented programming. [4]

d) Explain the term "encapsulation" by using the above example. [2]

7. *"It has come to light that the data of approximately 1.5 million patients who visited SingHealth's specialist outpatient clinics and polyclinics between the date of 1 May 2015 to 4 July 2018 have been illegally accessed and copied. The data stolen include the names, NRIC numbers, addresses, genders, race and dates of birth of the patients. Information on outpatient dispensed medicines of about 160,000 of these patients were also compromised.*

…

Singapore is pushing for it to be mandatory for all healthcare institutions (both in the private and public sectors) to contribute patient data to the National Electronic Health Record (NEHR), in a move aimed at providing better care for patients.

…"

- SingHealth Data Breach (by Ghui on Wednesday July 21, 2018)

a) Read the above segments of article. Explain the difference between data at rest and data in transit. Identify which kind of data is compromised in this scenario. [3]

b) It is critical for software engineers to ensure the security for both data in transit and data at rest. Describe one effective strategy for each of these two categories. [2]

c) In the article, it also highlighted that the government is trying to push for a mandatory measure in managing patient data, namely NEHR. Comment on the advantage and disadvantage of this measure from data protection point of view. [2]

8. The following pseudo-code can be used to perform a range search on a binary search tree that contains `n` unique integers.

```
PROCEDURE rangeSearch(node : NODE,
                      low  : INTEGER,
                      high : INTEGER) BEGINS
    nodeValue <- node.getValue()
    IF node.hasLeftNode() THEN
        rangeSearch(node.leftNode, low, high)
    ENDIF
    IF nodeValue >= low AND nodeValue <= high THEN
        OUTPUT(nodeValue)
    ENDIF
    IF node.hasRightNode() THEN
        rangeSearch(node.rightNode, low, high)
    ENDIF
END PROCEDURE
```

By calling `rangeSearch(rootNode, 20, 40)`, all integers with values between 20 and 40 inclusive in the BST headed by `rootNode` are output in order.

a) State the time complexity of the procedure `rangeSearch`. [1]

b) The pseudo-code provided is inefficient. Rewrite a version to improve tis efficiency by modifying the existing pseudo-code. Explain why your version is better and state the worst-case scenario. [4]

9. Mao Mao Shan Durian (MMSD) is a small fruit shop in ABC wet market that sells high quality Malaysia durians. Over the year, its reputation grows, and its business becomes so good that customers begin to face difficulty placing orders. Mr. Tan who is the boss of MMSD decided to engage a software house find a digital solution to make the ordering process more efficient.

Therefore, the software house sent a team down to talked to Mr. Tan and his staff. At the same time, he observes the ordering processes in the shop. Currently, customers can place pre-orders by dialing or patronizing the local shop. Customers who patronized the store can pay full in advance and are guaranteed to receive their durians within a week. However, those who dialed in are not guaranteed (since they haven't paid for the durians) and they will pay during durian collection. Once pre-orders are made, customers will be informed on the date and time for their durian collection by SMS. For both ordering methods, the pre-order information collected by the staffs are written on paper manually.

a) Describe 4 important pieces of information collected by the staff. [2]

b) Describe 2 problems in the existing ordering methods. [2]

c) Draw a flow chart for the ordering process described above. [3]

d) Who should be in the team sent by the software house. [1]

Two major observations are made by the team:

- Large number of customers are always found waiting around the shop during the durian seasons.
- It is tedious to manage the pre-order calls and reply to the customers on the collection dates.

The software house then creates a proposal which offers two solutions:

1. To develop a cloud-based durian pre-order system that is accessible to the public where online customers order, pay and receive their durians by delivery.
2. To develop a web host on a private WLAN that covers only the area around the wet market where customers who patronize the shop can order, pay and know when to collect the durians.

e) Describe the pros and cons of the 2 solutions. [2]

f) Describe what should be included in this proposal. [4]

After some consideration, Mr. Tan decides to take the second solution only.

g) State the name of the document to be produced after the proposal is accepted. [1]

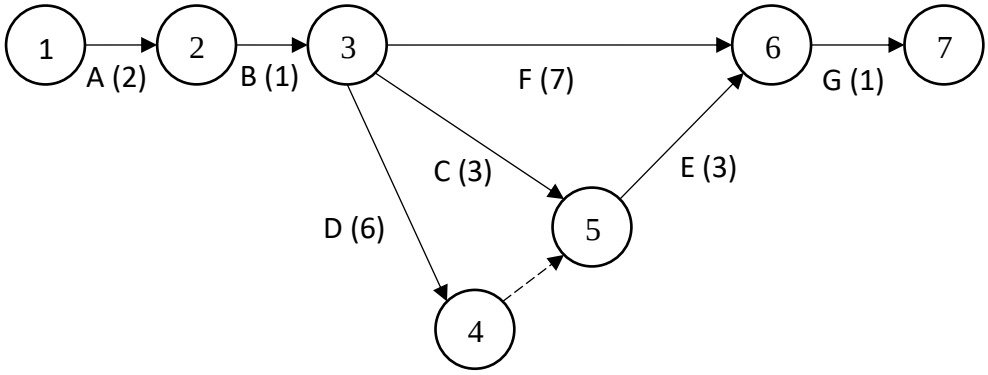
h) State the name of the role of the person who writes this document. [1]

i) State 4 items in this document. [2]

j) Design and describe the new procedure required for the durian pre-order, payment and collection process of these customers. Illustrate with the GUI of the webpage.
Hint: Those who come for pre-order can do payment while those who come to collect must inform system that they have reached and pay if they haven't. [6]

k) Draw the Data Flow Diagram based on **j)**. [4]

The project manager uses both PERT and Gantt chart to manage the project. The PERT chart is as shown below. Phases are measured in weeks.



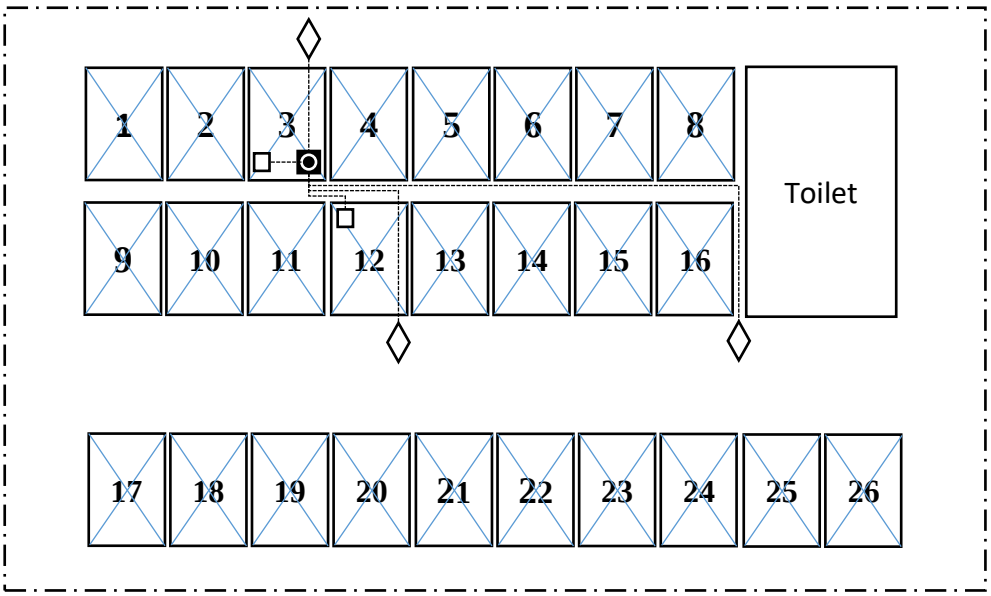
Activity	Phase
A	Investigation
B	Define hardware and software stack
C	Install hardware
D	Coding modules
E	System testing
F	Technical Documentation
G	User acceptance test

l) Convert the PERT chart to Gantt Chart. [2]

m) State the advantage of using the Gantt chart over a PERT chart. [1]

n) State the 4 key activities run by the project manager to monitor and control the development processes. [2]

The network engineer designed the WLAN and the floor plan of ABC wet market is as follow.




```
Legend
3   : Maomao Shan Durian Pre-Order Point
12  : Maomao Shan Durian Collection Point
◊   : Network device A
◙   : Network device B
□   : Terminal (including web server)
.....: CAT 6 LAN Cable with RJ45 termination
```

o) State the name of the devices A and B. [1]

p) State the additional hardware(s) and service(s) required if Mr. Tan wants to make online payment possible using the same WLAN and webhost and briefly explain how it is done. [2]

q) If the symbol rate is 9600 baud and each symbol represent three bits, what is the overall bit rate? [1]

r) If the bit time is 5 ns, what is the data rate in Mbps. [1]

s) State and justify the type of implementation should be used for the system. [2]

The End