Name:________________________________ Class:_____________

JURONG PIONEER JUNIOR COLLEGE

JC2 Mid – Year Examination 2023

COMPUTING
Higher 2

9569/01
26 June 2023

Paper 1 (Written)

1 hour

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 an 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 **30**.

This document consists of **3** printed pages.

[Turn over]

1 Study the following sorting code carefully:

```
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])
            else:
                  larger.append(lst[i])

           return sort(smaller) + [pivot,] + sort(larger)
```

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

b) Explain why the above sorting algorithm is inefficient when it is used on a nearly sorted array. [1]

c) Explain how you can modify the code to improve the efficiency. [2]

d) State the worst-case time complexities for bubble and insertion sort. Explain why bubble sort is generally less efficient than insertion sort. [2]

2 Consider the following hash function for a hash table that uses linear probing (i.e.: insert into the next available space) to resolve collisions:

```
FUNCTION Hash (key: INTEGER) RETURN INTEGER
     RETURN (key + 3) MOD 7
ENDFUNCTION
```

Assume that the 0-based hash table array has a capacity of 7 and initially all slots are empty.

a) Suppose the keys 5, 12, 1, 16, 17, 15 are inserted into the hash table in this order. Illustrate the resulting hash table array after all the insertions are completed. [1]

b) If we now search for the key 3, what is the expected number of comparisons needed? Explain your answer. [3]

c) Explain why implementing a good hash function is important for the performance of a hash table. Describe a situation where a bad hash function could lead to poor performance. [2]

3 The manager of a local restaurant engaged a consultant to propose a digital solution for his restaurant operations. After conducting a comprehensive study, the consultant proposed a web-based solution using a **client-server model**.

The solution requires the following hardware to access the web server **wirelessly**:

1. A tablet device on each table for customers to browse the menu and order food items.
2. Multiple large monitors for the chefs in the kitchen to read the ordered food items.
3. A computer station for the service staff to check the table number before serving the food to the customers.
4. A computer in the manager's office to update the menu in the web server and print the daily sales report.

When a customer decides to pay the bill, a QR code will be generated on the tablet device for him to scan and make online payment using his personal mobile device.

a) State one advantage and one disadvantage of client-server model compared to peer-to-peer. [2]

The restaurant's manager is also keen to expand his business to accept **online ordering** for remote customers to perform takeaways.

b) Draw the network diagram for the proposed web-based solution and include all the required hardware for the restaurant to accept online ordering. [4]

c) Describe how data is transmitted to the server when customers make orders. [5]

In the client-server model, customer orders are put into a queue.

d) Describe how a queue works in this context. [1]

This queue can be implemented in object-oriented programming as a data structure. The implementation of this queue requires two integer variables and an array.

e) Name and describe the purpose of the two integer variables. [2]

f) Describe the implementation of the two methods of the queue data structure to insert and delete orders. [4]

END OF PAPER