



HWA CHONG INSTITUTION

C1 Promotional Examination

Higher 2

Computing

Paper 1

9569/01

26 Sep 2024

3 Hours

Candidate Name	
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CT Group	
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READ THESE INSTRUCTIONS

Write in dark blue or black pen. HB pencil may be used for graphs and diagrams only.

Answer **ALL** questions.

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

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

Arrange in the correct order of the questions.

Total marks for this paper is **100** marks.

This document has **6** printed pages.

For Examiner's use only	
Question Number	Mark
1	
2	
3	
4	
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9	
Total	

- 1 (a) Explain the need for communication protocols in a network. [1]
(b) Give **one** reason why layering is necessary in the TCP/IP model. [1]
(c) Give **two** advantages of TCP over UDP. [2]
(d) Describe **two** differences between a switch and a router. [2]

- 2 (a) Explain the term Domain Name Server (DNS) and how it works. [5]
(b) Describe the **two** methods that a DHCP server adopts to allocate an IP address to a client and its 4-step lease process. [6]

- 3 (a) Explain the purpose of data validation and give **two** examples. [3]
(b) Explain the purpose of data verification and give **one** example. [2]
(c) One social media company employee intentionally deactivated the account of a famous political figure for 11 minutes. Describe **one** breach of the code of ethics committed by this employee as a computer professional. [1]

- 4 Some algorithms can be written using recursion.
(a) Explain the two differences between an iterative solution and a recursive solution to a problem. [4]
(b) Explain how a stack is used when a recursive call is made. [4]
(c) Name the error and the type of error that might occur when the recursive function is executed with a large problem size. [2]

- 5 A transport company uses a relational database to store customers' booking of bus tickets.

An initial database was designed with two tables. The following is the table description of the two tables.

Bus (VehicleNo, Capacity)

Booking (VehicleNo, CustomerID, CustomerName, CustomerContactNo,
Date, Quantity)

The table descriptions can be expressed as

TableName (Attribute1, Attribute2, Attribute3, ...)

The primary keys are indicated by underlining one or more attributes. Foreign keys are indicated by using a dashed underline.

- (a) Describe, with example, **one** possible issue with the way the customer bookings are stored. [2]
- (b) Explain why the table Booking is **not** in third normal form (3NF). [2]
- (c) Write table descriptions for **two** tables to hold the data from Booking table, each of which are in third normal form (3NF) **without** introducing any additional fields. [3]
- (d) Create an entity-relation (ER) diagram for the database. [2]
- (e) The transport company needs a report that displays the vehicle number, capacity, customer name, customer contact number, date, quantity. Write SQL query that output the required data for vehicle no. "PA1234S" and display the records starting from the most recent date. [5]
- (f) The company would like to use the same bus for multiple trips per day. Explain why the design in part (b) is able/not able to support the operation changes by the company. [2]
- (g) State **one** personal data the transport company collects from the customer. Explain why the data collected is classified as personal data. [2]
- (h) State **two** actions the transport company must take regarding the collection, disclosure and use of this data under the Personal Data Protection Act. [2]

- 6 Binary strings are often written in groups of 4 bits, or nibbles.
- (a) Give 2 possible reasons why they are written in blocks of 4 bits. [2]
 - (b) Convert hexadecimal strings `DAB` and `50FA` into binary strings, giving your answer in blocks of 4 bits. [2]
 - (c) Write a **pseudocode** function `hex2bin(num: string)` which converts a hexadecimal string and returns a binary string with the same numerical value. [4]

The standard ASCII character set includes both control characters and common printable characters. The characters are easily converted into binary for encoding purposes.

- (d) How many characters does the standard ASCII character set contain? [1]

Most websites use Unicode encoding methods such as UTF-8.

- (e) Explain why Unicode methods such as UTF-8 is preferred over ASCII. [2]

- 7 In a school canteen, the Korean food stall uses a digital queue system. The 2 vendors who work at the stall takes up to 8 orders, giving out queue numbers to the next 8 customers who have placed their orders. A program manages a circular queue using a fixed size array.

The class `Queue` contains three attributes:

- `orders` a 1-dimensional list of food orders, indexed from 0 to 7
- `start` the index of the first order in the queue, initialised to -1
- `end` the index of the last order in the queue, initialised to -1

- (a) Write, in **pseudocode**, the function `order(food)`, which takes `food` as a parameter and adds it into the queue., returning `True` if this is successful, or `False` otherwise. [5]
- (b) Write, in **pseudocode**, the function `serve()`, that removes the first item in the queue and returns the removed item, or `False` when empty. [4]
- (c) Write, in **pseudocode**, the function `printQueue()`, which outputs all current contents in the queue, from the first item in the queue to the last, without removing any of the items. [3]
- (d) Explain why a stack data structure is not suitable in this scenario. [2]

- 8 The following tables are records of train models in the Singapore fleet of trains in 2007.

<u>Train A</u>		<u>Train B</u>	
Model	Kawasaki C151	Model	Alstom C751A
Year of commission	1987	Year of commission	2003
Lines of operation	NSL, EWL	Lines of operation	NEL
Capacity (pax)	1920	Capacity (pax)	1920
Seats	372	Seats	298

Bryan, a train hobbyist wrote the following Python code for his computing project. The first 2 methods of this class are shown.

```
class Train:
    def __init__(self, name, year, pax, seats, lines):
        self._model = name
        self._commission = year
        self._capacity = pax
        self._seating = seats
        self._operation = lines

    def show_details(self):
        print("Model:", self._model)
        print("Year of commission:", self._commission)
        print("Capacity:", self._capacity)
        print("No. of seats:", self._seating)
        print("Lines of Operation:", self._operation)
```

- (a) Suggest a suitable datatype for each of the attributes in the `Train` class. [2]
- (b) Write the **Python** code that would initialise the object Train A using the information given above, and use the `show_details` method to show its attributes. [2]

In 2009, when Circle Line was operational, the new trains on the Circle Line only had a length of 3 cars while the older lines used trains that had a length of 6 cars. Bryan decided to create a new subclass for the 3-car long trains `Train3`. This subclass possesses the new attribute `length`.

- (c) Write the **Python** code for the new class `Train3` and the `__init__` method, showing clear use of the existing class `Train`. [3]
- (d) Explain the purpose of encapsulation in OOP using the example above. [2]

9 Write your code in **Python** for this question.

A seminar room's seating is arranged in a grid of 10 rows and 10 columns for public events.

The seating arrangement is represented as a 2D array where the value at row *i* and column *j* is

- 1 if the seat is occupied
- 0 if the seat is vacant

(a) Write a program to generate a random 10x10 grid `room`. [2]

(b) Write a function that takes the grid `room` and returns the total number of occupied seats in the seminar room. [2]

(c) Write a function that checks if any columns are completely occupied. This function takes the grid `room` and returns a list of indices of such columns. If there is no completely occupied column, the function returns an empty list. [2]

(d) Write two functions that check the occupancy of the main diagonal (top-left to bottom-right) and the anti-diagonal (top-right to bottom-left). The two functions return `True` if all seats in a diagonal are occupied, otherwise return `False`. [4]

(e) Write a function to identify the row(s) with the maximum number of occupied seats. This function takes the grid `room` and returns a list of indices of the row(s) identified. [3]