



HWA CHONG INSTITUTION

C1 Promotional Examination

Higher 2

Computing

Paper 1

9569/01

26 Sep 2023

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 **7** printed pages.

For Examiner's use only	
Question Number	Mark
1	
2	
3	
4	
5	
6	
7	
8	
Total	

1. (a) What is the purpose of a network protocol? [1]
- (b) Transmission Control Protocol (TCP) is one of the core protocols of TCP/IP suite and plays a fundamental role in network communication. Describe **two** characteristics of Transmission Control Protocol. [2]
- (c) Describe the steps involved in the 3-way handshake used by Transmission Control Protocol (TCP). [3]
- (d) State the purpose of the following protocols in the application layer in the TCP/IP suite:
- (i) HTTP
 - (ii) SMTP
 - (iii) POP3
 - (iv) DHCP
- [4]
2. (a) Explain the purpose and give one example for each of the following techniques:
- (i) Data Validation [2]
 - (ii) Data Verification [2]
- (b) Explain the term Domain Name Server (DNS) and how it works. [5]
- (c) Alvin is a student working on his final year project which requires the use of the school server. As the servers are shared by multiple projects, his mentor has assigned a fixed amount of time for his project to ensure fair usage and access for all students.
- However, on the day before his project submission, Alvin faces a problem. He is unable to complete his project because he has exhausted the allocated time on the servers, and he is unable to reach his mentor for assistance.
- As a student helper for the school computing center, Alvin possesses knowledge about the procedures to increase time allocations to user accounts. Using his knowledge, he allocated additional time to his project to complete his project.
- Analyse and describe the **two** ethical issues involved based on the Code of Ethics of a Computing professional. [2]

3. (a) Describe **two** differences between an iterative solution and a recursive solution to a problem.

[4]

(b) Consider the following pseudocode algorithm:

```
FUNCTION P (n: INTEGER) RETURNS BOOLEAN
  IF n = 0
    THEN
      RETURN FALSE
    ELSE
      RETURN NOT P (n-1)
    ENDIF
  ENDFUNCTION
```

(i) Draw a trace diagram for the recursive function call P (3) and give the final result returned. [5]

(ii) Describe the purpose of function P. [1]

4. (a) Write, in **pseudo-code**, a function to convert a denary integer into a hexadecimal string.

The function header has the format:

```
FUNCTION Den2Hex (Denary: INTEGER) RETURNS STRING
```

You may assume you have a helper function HexHelper (n: INTEGER) that does the following:

```
returns 'A' when given n is 10;
returns 'B' when given n is 11;
returns 'C' when given n is 12;
returns 'D' when given n is 13;
returns 'E' when given n is 14;
returns 'F' when given n is 15. [5]
```

(b) Show your working, express the hexadecimal number 1C2 as:

(i) a denary number [1]

(ii) a binary number [2]

(c) Give **two** advantages of using hexadecimal number to represent data. [2]

5. Patients in a hospital can opt to stay in class A or class B room. Class B patients enjoy subsidy to their total bill incurred during their stay in hospital. The subsidy varies from 10% to 50% depending on their yearly income. Class A patients do not enjoy any subsidy. However, they are provided with chargeable SPA and VOD (video on Demand) facilities in their rooms.

A programmer uses object-oriented approach to design the Electronic Billing System.

Each patient has a unique NRIC number, a name, gender, age and an address recorded.

- (a) Draw a class diagram that shows how the properties could be distributed amongst a number of classes. Include in your diagram any inheritance between classes. Also indicate appropriate methods that would be required. One method should demonstrate polymorphism. [7]
- (b) Explain the purposes of a public method. [2]
- (c) Explain why polymorphism is useful in object-oriented programming. [1]

6. An order form used by the customers of a supplier of goods has the following form:

Customer Order Form				
Order Number: _____				
Customer ID: _____				
Name: _____				
Address: _____				
Tel: _____				
Date: _____				
Product ID	Product Name	Quantity	Price	Cost
			Total Cost	

- Each customer may send many orders.
- Each order may have multiple lines of products.
- One line contains the details for the order of an individual product.
- A product can appear only on one line in an order.
- A product may occur on many different orders.

The data are to be stored in a relational database.

- (a) Identify the tables that will give a normalised solution to this problem. Draw an entity-relationship (ER) diagram that shows these tables and the relationships between them. [5]

- (b) A table description can be expressed as:

TableName (Attribute1, Attribute2, Attribute3,)

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

Write table descriptions for the tables you identified in part (a) so they are in third normal form (3NF). [6]

- (c) With your design in part (b), write a query to retrieve all products that had been ordered by CustomerID = 2. The SQL query should show order number, order date, product ID, and product name, in descending order of the order date. [6]
- (d) Making backups and archives are performed to prevent the loss of data. State a difference between a backup and an archive. [2]

7. A linked list ADT is implemented using a collection of nodes that have two parts: the node data and a next pointer to the next node in the linked list.

The linked list ADT has a Head pointer which points to the first node in the linked list. The node data are arranged in ascending order in the linked list.

The linked list ADT has the following operations defined:

- Create(*x*) – creates an empty linked list *x*;
- Insert(*x*, *new*) – inserts data, *new*, into linked list *x* in ascending order;
- Delete(*x*, *target*) – deletes the node with data *target* if it exists in the linked list *x*, otherwise output error message;
- Read(*x*) – returns the data value of the first node in the linked list *x*;
- Length(*x*) – returns the number of nodes in the linked list *x*.

- (a) Draw diagrams to illustrate the linked list after inserting ‘Ethan’, ‘Cruise’, ‘Mission’, ‘Possible’. [4]

- (b) Write algorithms to implement the Insert, Delete and Length operations.

[11]

A stack ADT has the following operations:

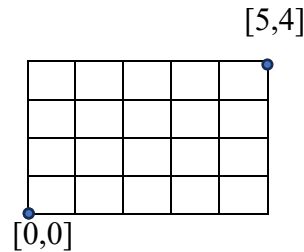
- Create(*s*) – creates a new stack *s*;
- Push(*s*, *new*) – adds *new* onto the stack *s*;
- Pop(*s*) – deletes item from the stack *s*;
- Read(*s*) – returns the data value of the first node in the stack *s*;
- Length(*s*) – returns the number of nodes in the stack *s*;

- (c) Write down the statement to use the linked list ADT operations to implement the Pop operation of the stack ADT. [1]

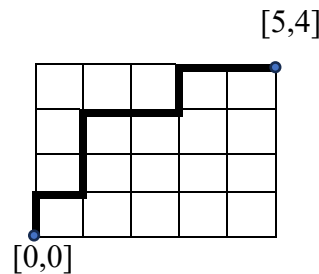
- (d) Identify one operation of the stack ADT that cannot be implemented using the linked list ADT operations and explain why. [2]

8. Write your answer in **Python** code for this question.

An ant is starting from the point $[0,0]$ in the grid below and moving towards the point $[5,4]$. The ant can only move up or right to the next grid point in every step it makes.



- (a) Write a function `simulate` that generates a random path for the ant and returns a collection of all the points it has passed. [6]



For example, the path above returns a collection of the points below:

$[0, 0]$, $[0, 1]$, $[1, 1]$, $[1, 2]$, $[1, 3]$, $[2, 3]$, $[3, 3]$, $[3, 4]$, $[4, 4]$, $[5, 4]$

- (b) Now every grid point has a random number of golds, ranging from 0 to 10 golds.

Write a program code that does the following:

- Generate the number of golds for all the grid points and store these numbers in a data structure
- Use the `simulate` function in part (a) to generate a path and calculate the total number of golds that the ant collects along this path. [6]