HWA CHONG INSTITUTION
C2 BLOCK TEST 2021

COMPUTING
Higher 2

1 July 2021 **Paper 1 (9569 / 01)** **1400 -- 1515 hrs**

READ THESE INSTRUCTIONS FIRST

Write in dark blue or black pen on both sides of the paper.

You may use a soft pencil for any diagrams, graphs, tables or rough working.

Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

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

Total marks for this paper is **40** marks.

This document consists of **4** printed pages.

1 One layer of the TCP/IP protocol makes use of IP addresses. An IP address is a 32-bit number, for example, 205.123.4.192 is an IP address.

Part of the IP address is used for the network ID, and part of the address is used for the host ID.

(a) Explain the terms network ID and host ID. [2]

Most IP addresses fall into one of three classes:

- If the 32-bit address starts with a 0 bit, the address is a Class A address.
- If the 32-bit address starts with the bits 10, the address is a Class B address.
- If the 32-bit address starts with the bits 110, the address is a Class C address.

(b) Show how to determine whether 205.123.4.192 is a Class A, Class B or Class C address. [2]

(c)

- In a Class A address, the first byte represents the network ID and the remaining three bytes represent the host ID.
- In a Class B address, the first two bytes represent the network ID and the remaining two bytes represent the host ID.
- In a Class C address, the first three bytes represent the network ID and the remaining byte represents the host ID.

For the address 205.123.4.192 state the network ID and host ID. [1]

2 **(a)** The following are types of data structure:

A. Stack
B. Queue
C. Binary search tree
D. Hash table
E. Two-dimensional array
F. linked list

For each of the following software requirements, state with a reason, which of these data structures would be the most suitable. Each data structure should be used once only.

(i) The implementation of a spreadsheet package
(ii) Storage of customer ID transformations for retrieving customer information
(iii) Simulating traffic moving down a narrow one way street
(iv) Implementing the back button on an internet browser
(v) Searching data in an ordered structure
(vi) Inserting records of customers into an ordered list of records

[2]

(b) A zoo maintains a file of birds, organised as a linked list in alphabetic order.

(i) Using a diagram, show the list for the birds
`Pheasant, Teal, Parrot, Woodpigeon`
(You should include reference to free space in your diagram) [2]

(ii) Explain how `Pheasant` can be removed from the list. [3]

(iii) Write a recursive algorithm, in pseudocode, to output the birds in the list in reverse order. [3]

3 **(a)** Explain what a protocol is and why it is needed in a computer network. [2]

(b) Explain **three** differences between using packet switching and circuit switching in the transmission of a message. [3]

4 A vehicle service center uses a relational database to keep track of the customers' booking records. The database includes services that have been completed and those that are waiting to be done.

A database analyst suggests a design with the two tables below where the primary key is underlined.

`Service(ServiceID, VehicleRegNo, ServiceDate, ServiceDuration)`

`Vehicle(VehicleRegNo, Brand, Model, OwnerName, OwnerContactNo)`

- Each vehicle has a unique `VehicleRegNo`.
- A booking made for a vehicle on a particular date counts as one service, regardless of how many different tasks are completed upon it.

(a) The database analyst realizes that the owner details should not be stored in the `Vehicle` table and that a new table should be created to store the owner details. Explain why storing the owner details separately would improve the design of the database. [1]

(b) Provide the table description of the improved database design as suggested in **(a)**. [2]

(c) Draw an Entity-Relationship (E-R) diagram to represent the data model of the improved database design based on the table description in **(b).** [3]

(d) If the `ServiceID` attribute is not included in the `Service` table, which other attribute or attributes that are currently in the table can be used as the Primary Key? [1]

When a booking is made for a service, a record will be added to the `Service` table. At the time of booking, the `ServiceDuration` attribute will be set to 0. When the service is completed, the `ServiceDuration` attribute is updated to indicate the amount of time the service took in minutes.

(e) The service engineer needs to produce a list of services that have been booked but have not been completed. The list must include `ServiceID`, `VehicleRegNo`, `ServiceDate`, `Brand`, `Model`, `OwnerName`, `OwnerContactNo`. Based on the design in **(b)**, write an SQL query to produce the list. [3]

The service center will offer servicing for electric and non-electric vehicles. A software developer will use an object-oriented approach to develop a new application to help the service engineers keep track of the service records, including the basic information, the service checklist and the next service schedule.

The application will have functions to

- print out a hard copy of the checklist based on the type of vehicle – electric or non-electric.
- compute the next service date based on the type of vehicle:
  - For non-electric vehicles, the next service date is three months from the current date
  - For electric vehicles, the next service date is determined based on the number of years driven.

(f) Draw a class diagram that shows the following for the application described above.

- the superclass
- any subclasses
- inheritance
- properties
- appropriate methods [6]

(g) Describe how your design in **(f)** demonstrates code reuse. [2]

(h) Explain the term **polymorphism** and how it is applied in your design in **(f)**. [2]

--- END OF PAPER ---