PIONEER JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION

COMPUTING H2   **9597/02**

Paper 2   **16 Sep 2015**

Time: 0800 - 1100   **3 hours**

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your name, CT Group, and Index No. in the spaces provided on this cover page and on your answer scripts.

Write your answers on the writing paper provided and **NOT** on the question paper.

Answer **all** questions.

INFORMATION FOR CANDIDATES

This question paper consists of **7** printed pages (inclusive of this page).

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

The use of an electronic calculator is expected, where appropriate.

You are reminded of the need for clear presentation in your answers.

1. PJ Parcels is a company that specialises in the delivery and collection of parcels for business customers. To use their services, a customer must first register for an account. The customer needs to provide their company name, address, telephone number and the name of a main contact for any queries.

As part of the registration process, the customer will have to decide if they wish to pay monthly on receipt of an invoice, or via credit card for each delivery made. If paying by credit card, then the card details are also required. Once these details have been accepted, the customer will be issued with an account number that they must quote when contacting the company.

When a customer requires a parcel to be delivered, they will contact PJ Parcels to arrange collection. The customer needs to provide details of where the parcel will be collected from; where it will be delivered to; how many parcels are to be collected and which type of service they want, for example, next day delivery.

Once the collection has been arranged, an Airway Bill will be generated. The details on this will be used by a Dispatcher to schedule the vehicle needed for the collection. Each parcel will be given a priority number by the Dispatcher and those with the highest priority will be collected first.

By 12 noon each day, the Dispatcher also needs to generate a delivery schedule to ensure all the parcels are delivered according to the service required.

Each Driver has a mobile device with a copy of the Airway Bill; a person at the delivery address must sign this to say that the parcel has been delivered. This will flag that the delivery has been completed.

Once the parcel has been delivered, if the customer pays via credit card, their card will be debited by the amount required, or if they pay monthly, then the invoice account will be debited. Once a month, the Finance Department will generate the invoices for payment.

If the parcel cannot be delivered for any reason, it will be returned to the Depot and a card will be left with at the delivery address with details of how to arrange re-delivery.

The company has decided to replace this manual system with an on-line computerised system.

A **system developer** is employed to carry out the task. The first task assigned to the system developer is to write a project proposal.

(a) One section of the project proposal is the Problem Statement which lists the **[4]** problems in the current system. Write the Problem Statement.

(b) The system developer (who will act as project manager) has drawn up an initial plan of the work involved:

Stage	Activity	Weeks
A	elicit requirements from the intended users, and draw up a specification	3
B	system analysis	2
C	system design	7
D	system development	5
E	system testing	4
F	implementation of computer system	2
G	documentation	3
H	maintenance	2

Task B must follow A.
Tasks C, D and E can run concurrently, but must follow B.
Tasks F and G can run concurrently, but cannot start until all three tasks C, D and E have been completed.
Task H must follow tasks F and G.

(i) Draw a Program Evaluation and Review Technique (PERT) chart for this project. Use week numbers as the time units. **[4]**

(ii) Copy the following table and complete the earliest and latest start and end time, and the float, for each node. **[3]**

Task	Duration	Earliest Start Time	Latest Start Time	Earliest Finish Time	Latest Finish Time	Float
A	3	0	0	3	3	0
B	2	3	3	5	5	0
C	7					
D	5					
E	4					
F	2					1
G	3	12			15	0
H	2		15		17	0

(iii) State the critical path. **[1]**

(iv) State the minimum time in which the project could be completed. **[1]**

(v) Explain dependent stages and concurrent stages. For each type of stage give an example from this chart. **[4]**

(vi) Draw a Gantt chart showing all eight stages and their dependencies, allowing for the resource allocations as indicated above. **[4]**

(c) Identify **five** key stages with brief description of the software development life cycle (SDLC). **[5]**

(d) Explain at which stage of the SDLC was top-down analysis used, and why it helps in the solution of complex problems. **[2]**

(e) The parcel's data from customers entered into the new system needs to be **[4]** validated and verified.
Explain with examples the difference between data validation and data verification.

(f) Jane is the software testing engineer for this system. Her test strategy includes beta testing and acceptance testing.

    (i) Describe what is meant by beta testing and how it can be used to test the **[2]** program.

    (ii) Describe what is meant by acceptance testing and how it can be used to test **[2]** the program.

(g) Some account clerks spend at least part of their week working from home. A **[2]** system analyst will assist in improving their company communication systems. Explain why it is important to define problem accurately.

(h) Some customers are worried because so much information is being stored about **[3]** their parcels on the server of the company. Describe the fears that the customers may have and explain what the company can do to allay those fears.

(i) When data is transmitted across the network it is sent in bytes. The following bytes **[2]** of data have been received by a device on the network.

        01101101   10110100   01101000   10100001

One of the bytes has been corrupted.
State which is the corrupt byte, justifying your choice.

(j) Explain how transmitting bytes in **blocks** can allow the receiving device to self- **[2]** correct errors.

(k) When data is transmitted on a network it can use a number of different transmission modes. State what is meant by each of the following modes of data transmission.

    (i) Simplex **[1]**

    (ii) Duplex **[1]**

    (iii) Half-duplex **[1]**

2. A programmer is going to write part of the new system, using an object-oriented programming language, which will store details of customers. All customers will be identified by their CUST_ID. Properties identified type of customers is:
   - Payment_type

   (a) Draw a diagram that shows how the properties could be distributed amongst a number of classes. Include in your diagram any inheritance between classes. Also indicate some of the methods that would be required. **[4]**

   (b) In the context of object-oriented programming explain what is meant by:

   (i) encapsulation; **[3]**

   (ii) inheritance;

   (iii) polymorphism.

   (c) Give **two** advantages of object-oriented programming. **[2]**

3. A recursive algorithm for finding a value, SearchItem, in an ordered array, X, is as follows:
   Search(Low, High)
           Mid =(Low + High) div 2
           If X(Mid) = SearchItem then output "found" : exit
           If X(Mid) > SearchItem then Search(Low, Mid-1)
                   Else Search(Mid+1, High)
   End Search
       Note: the div operation returns an integer value after division e.g. 7 div 2 = 3

   Using the above algorithm:

   (a) Explain what is meant by a recursive algorithm. **[1]**

   (b) Describe what might occur during execution with an incorrectly written recursive routine. **[2]**

   Array X has 15 elements and the subscripts start at 1.

   (c) If the algorithm was used to search the array X for the value stored at X(3) state the calls to Search as the recursion executes. **[2]**

   (d) The algorithm does not handle the case where SearchItem is not present in X. Indicate what changes need to be made to Search to rectify this problem. **[3]**

   (e) For this method of searching state the maximum number of comparisons and the minimum number of comparisons for array X, justifying your answers. **[2]**

4. An alternative solution for this project is to use cloud computing. **[3]**
   Discuss briefly the **three** services that could be used for the new project.

5. PJC Enterprise plans to create a computer system to store data on its employees and the insurance type and coverage for each of them. An employee may be insured by more than one policy. A solution is to create a database with three tables: *Employee*, *Insurance* and *Policy*.

    Employee table contains information about its employees. *Insurance* table gives information on the insurance plan type and the date of issue of the policy for an employee. *Policy* table contains, for each type of insurance plan, a description of its coverage and its monthly cost.

    (a) Draw a fully labelled ER diagram (with attributes) to show how the tables *Employee*, *Insurance*, *Policy* are related, while keeping data redundancy to a minimum. **[5]**

    (b) Using examples taken from this application explain what is meant by:
        (i) a primary key **[1]**
        (ii) a foreign key **[1]**
        (iii) a composite key **[1]**

    (c) Write a SQL query to find the monthly cost of Jessie Tan's insurance. **[2]**

    (d) Explain why using a database for PJC Enterprise, rather than flat files, results in:
        (i) improved data consistency **[2]**
        (ii) prevention of data redundancy **[2]**
        (iii) data independence **[2]**

    (e) Explain how the following tools can help employees of PJC Enterprise make use of data in a database.
        (i) query language **[2]**
        (ii) report generator **[2]**

6. A computer system is to be used to monitor the condition of patients in a ward of a hospital. The computer system can help to identify the patient, monitor the respiratory rate, heart rate, blood pressure and temperature, and administer the medicine and its dosage.

    (a) Describe **two** input devices for such a computer system and how they can be used by the user. **[4]**

    (b) Describe **two** output of the system, and give reasons why they are useful. **[4]**

    (c) Describe the effects on the jobs of the nursing staff by the introduction of such a computerised system. **[2]**

7. A supermarket has a membership scheme and offer discounts to members who make purchases. The rules that apply to its customers making purchases and offered discounts are as follows:

- if a customer spends $50 or more in a single transaction, a 3% discount would be given,
- if a customer spends $150 or more in a single transaction, a 10% discount would be given,
- for payment by cash, an **additional** 1% discount would be given, on top of the discount.

Create a decision table and **simplify it by removing redundancies**. **[5]**

8. A system to produce utility bills starts with a hand held device to record the meter **[5]** readings. The readings are then recorded into a file and processed against the customer master file to produce the printed utility bills for the customers.

Draw a data flow diagram for this system.

9. **(a)** For the following list, perform an insertion sort in ascending order. Show the list **[3]** after each exchange.

98, 12, 23, 8, 74, 30, 62

(b) Write an algorithm in pseudocode for the insertion sort. **[6]**

(c) Why is insertion sort preferred to bubble sort? **[1]**

~~~ **END OF PAPER** ~~~