Candidate Name: _____ CT Group: _____

Index no. _____

PIONEER JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION

COMPUTING H2 **9597/02**

Paper 2 **23 September 2014**

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 **9** 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 A manual system for producing school student reports works in the following manner:

- a subject report is completed for each subject that a student takes by the single teacher teaching that subject;
- to help the subject teacher, initially a blank report form is issued to the student for the student to add their details: student NRIC, name, contact phone, teacher and class;
- the subject report is completed by the teacher with appropriate comments;
- all subject reports for the student are passed to the student's tutor;
- the tutor puts all the subject reports together to form the student's report folder;
- the tutor adds a tutor's report including attendance data supplied by the school administration attendance records;
- each student's report folder is copied;
- the copy is filed in the report storage facility for the school;
- the report folder is sent to the student's parents.

The school has decided to replace this manual system with a 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 problems in the current system. Write the Problem Statement. **[4]**

(b) The proposal is accepted and the main stages of the project have been identified and durations assessed as follows:

Stage	Description	Weeks	Staffing
A	analysis of the solution	4	Analyst A1
B	design of the solution	8	Analysts A2 and A3
C	development of the solution	12	Programmers P1 and P2
D	documentation of the solution	8	Clerks C1 and C2
E	implementation of the solution	6	Programmer P1
F	testing of the solution	4	Programmers P3 and P4

B and D cannot start until A is completed
F and C cannot start until B is completed
E cannot start until C is completed
The project will end when D, E and F are completed.

(i) Draw a Program Evaluation and Review Technique (PERT) chart for these 6 project stages (A to F). **[4]**

(ii) Calculate and display on the diagram, with a node layout key, the earliest and latest start and finish times of each task. **[4]**

(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) A decision is made that the PERT chart should show more detail with regard to testing. It is proposed that stage F (testing) should be removed from the chart and three new stages added: **[2]**

L – black box testing – 2 weeks
M – white box testing – 2 weeks
N – beta testing – 3 weeks

Redraw the PERT chart to show the effect of these changes.

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

(viii) List and explain briefly **TWO** advantages and **ONE** disadvantage of using a Program Evaluation and Review Technique (PERT) chart for a project plan in comparison with using a Gantt chart. **[3]**

(c) Identify **FIVE** key stages with brief description of the software development life cycle (SDLC). **[3]**

(d) At which stage of the SDLC is top-down analysis used? Explains why it helps in the solution of complex problems. **[2]**

(e) The attendance data enter into the new system needs to be validated and verified. Explain with examples the difference between data validation and data verification. **[4]**

(f) Marek is designing a program for this computerised system. His test strategy includes beta testing and acceptance testing.

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

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

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

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

(i) When data is transmitted between devices on a network it is liable to corruption. One way of checking data for corruption is to carry out a check sum. What is check sum? **[1]**

(j) Explain another method of checking data to ensure that it has been transmitted without corruption. **[2]**

(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 computer system, using an object-oriented programming language, which will store details subject teachers and tutors. All teachers and tutors will be identified by their NRICs.

Properties identified the subject teachers:

- Subject code

Properties identified the tutors:

- Class name

(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; **[1]**

(ii) inheritance; **[1]**

(iii) polymorphism. **[1]**

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

3 The words COW, BEEF and FORTY have all their letters written in alphabetical order. Here is an algorithm for a function which checks whether all the letters in a word are in alphabetical order.

```
01 FUNCTION IsInOrder(Word)
02     IF LENGTH(Word) = 1 THEN
03         RETURN TRUE
04     ELSE
05         FirstChar = First character in Word
06         RestOfWord = All characters in Word except the first
07         IF FirstChar > RestOfWord THEN
08             RETURN FALSE
09         ELSE
10             RETURN IsInOrder(RestOfWord)
11         END IF
12     END IF
13 END FUNCTION
```

(a) State what is meant by recursion using this algorithm as an example. **[2]**

(b) The algorithm is tested with the call IsInOrder("Z"). **[2]**
State the value which will be returned.
State the lines of the algorithm which will be executed.

(c) Explain what happens if the algorithm is tested with a call IsInOrder(" ") where the value of the argument is the empty string. **[2]**

(d) Explain what happens when the algorithm is tested with the call IsInOrder("APE"). **[4]**
You should show each call made, the lines of the algorithm executed and the return value of each call. You may use a diagram.

4 Character sets are used in computers to perform tasks.

(a) Explain how a character set is used by a computer. **[2]**

(b) Explain the differences between Unicode and ASCII. **[2]**

(c) The ASCII representation for character A is 65 (denary).

(i) What is the 8-bit binary number of the character E? **[1]**

(ii) What is the hexadecimal representation of the character E? **[1]**

(d) A bookstore stores details about *book code*, *title of book*, *author*, *unit price*, *number in stock* and *type of book* using a computer. The field which stores the *number in stock* is stored as a one byte binary integer.

(i) Explain why character and floating point representations would **not** be appropriate for this field. **[2]**

(ii) Describe a situation which could cause the suggested representation to fail and state how the problem can be overcome. **[2]**

5 Pioneer Book Store sells books online and charges for delivery. Its delivery charges for orders less than $200 are as follows:

- If the number of items is 3 or less, delivery by next day will be charged at $30, while standard delivery will be charged at $2 per item.
- If the number of items is 4 or more, delivery by next day will be charged at $5 per item, while standard delivery is free.

For orders more than $200, standard delivery is free for any number of items, while delivery by next day will be charged at $5 per item.

(a) Draw a decision table showing clearly the different conditions and actions, removing the redundancies. **[6]**

Customers can view a catalogue of books and order from its website. Payment is made by the customer forwarding their credit card details, which are processed immediately. Details of the orders are matched against the stock file to check for availability of items before packing lists are produced and sent to the packing department.

(b) Draw a data flow diagram to explain the flow of data through this system. **[6]**

New customers have to register with the online book store from its website before they can make any orders.

(c) Design a suitable user interface for a new customer to register with the online book store, showing its possible contents in terms of options presented to the user, justifying your design. **[4]**

6 **(a)** Names of employees are stored in a file. Show how a binary tree can be used to store the employee names: **Johnson**, **Henry**, **Larry**, **Stewart**, **Alice**, **Kennedy** in alphabetic order. **[2]**

(b) Explain why problems may arise if **Larry** is deleted from the tree and how such problems may be overcome. **[2]**

(c) Describe an algorithm for reading the complete set of names, stored in the tree, in alphabetical order. **[2]**

(d) As a result of many additions and deletions, the tree has become very unbalanced. For most nodes in the tree, the left and right subtrees are of significantly different sizes. Describe how a new balanced tree may be created. **[2]**

7 Pioneer Dental Group runs a number of clinics and requires its dentists to use forms, such as the ones shown (on the next page), to keep a record of treatments given to patients. Each patient has a number, name, and a category (for example, adult, child, student, senior citizen, etc.). A patient can received many treatments on the same day, but the same treatment is not administered twice on the same day.

DENTIST RECORD FORM		
Patient Number: P102 **Patient Name**: Yap Kim Meng **Patient Category Number**: 1 **Patient Category Description**: Adult		
Appointment Date	**Treatment ID**	**Treatment Description**
13-Aug-2013	T05	Root canal
13-Aug-2013	T03	Extraction
21-Oct-2013	T03	Extraction

DENTIST RECORD FORM		
Patient Number: P104 **Patient Name**: Christopher Thomas **Patient Category Number**: 2 **Patient Category Description**: Child		
Appointment Date	**Treatment ID**	**Treatment Description**
14-Aug-2013	T01	Scale and polish
14-Aug-2013	T02	Fillings
02-Sep-2013	T03	Extraction

(a) Explain why inconsistencies may occur as a result of operations to update and delete records. **[4]**

(b) Pioneer Dental Group would like to use a relational database to hold these data and needs to normalise the entities. Explain

(i) what entities are, **[1]**

(ii) what it means by normalisation. **[2]**

(c) Show using standard notation, the entities in the database after normalisation. For each of the entities, identify the primary key(s). **[6]**

(d) Before using a relational database, the dental group used a series of application programs that perform services for the end-users, such as to produce reports for dentists and for the individual clinics.

Discuss **three** disadvantages of this approach. **[3]**

END OF PAPER