Candidate Name: _____ CT Group: _____

Index no. _____

PIONEER JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION

COMPUTING H2 **9754/01**

Friday **14 SEPTEMBER 2012**

TIME 3 hours (0800 - 1100)

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 **5** 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 systems analyst has been employed to develop a computerised system for order processing in a retail business of a company.

(a) State **three** methods the systems analyst could use to collect information on the current manual system. Give an **advantage** for each of the stated methods. [6]

(b) The systems analyst, when documenting the system, can use a number of different diagrammatic methods to support what is written. Give **three** examples of diagrams that might be found in the technical documentation and explain why they are included. [6]

2. Top-down design is a technique used to produce solutions to the above problems,

(a) Explain the term top-down design. [2]

(b) Explain **three** advantages of using top-down design to solve complex problems. [6]

(c) Explain **three** techniques that can be used to ensure that program code is understandable. [6]

3. The software is tested for the presence of

(a) syntax,

(b) logic,

(c) arithmetic

errors. Explain what is meant by each of these types of error and state how they would be spotted by the programmer or user. [6]

4. The company decides to offer its customers the opportunity to place orders over the Internet. It also e-mails a weekly newsletter to registered customers.

(a) Give **three** advantages to the company of offering these services. [3]

(b) Explain why customers might be reluctant to use these particular facilities. For each problem describe how it can be solved. [3]

(c) Explain what data processing will be carried out after the company has received an order. [3]

(d) What can the company do to measure the effectiveness of the e-mailed newsletter in promoting the business? [3]

5. After the computerised system had been designed and developed, the company will need to change from using the old system to using the new one. Suggest ways in which this changeover could be managed. State the method you would recommend and give your reasons. [6]

6. **(a)** Describe the fetch-execute cycle, explaining the purpose of any registers involved. [5]

(b) Describe **three** different buses used in the processor. [3]

7. An operator takes phone calls from the public who enquire through phone calls for whether a particular item in a catalogue is available. The operator needs to ask the caller some questions and type in the responses, so that the file in the computer can be checked to determine whether that item is available.

(a) Suggest what type of interface is appropriate and its possible contents in terms of options presented to the user. [4]

(b) The technician responsible for maintaining the system uses a command line interface.

(i) What is meant by a command line interface? [2]

(ii) Give **one** advantage and **one** disadvantage to the technician of using a command line interface rather than a menu-based interface. [2]

8. An office worker is responsible for making backup copies of customer files and records of expenditure for a company and for archiving data.

(a) Explain the difference between backing up data and archiving it. [2]

(b) Describe a procedure that this worker could adopt for backing up the data files. [2]

9. A system to produce utility bills starts with a hand held device to record the meter 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. [5]

10. An algorithm is shown below, with line numbers by the side.

```
1   FUNCTION Secret(x,y)
2       p = x – INT(x/y) * y
3       IF p = 0
4       THEN
5           RETURN y
6       ELSE
7           RETURN Secret(y,p)
8       ENDIF
9   ENDFUNCTION
```

INT(number) returns the integer part of the parameter, number. For example, **INT(3.2)** returns **3** and **INT(17.8)** returns **17**.

The function **Secret** is called with **Secret(69,12)**.

Produce a trace diagram showing each step of the algorithm and the function calls. [6]

11. The names of 20 students are to be stored in an array called NAME(X) where X stands for a number between 0 and 19.

(a) Describe an algorithm to find the position of a particular student in the array, using a sequential search. [5]

(b) Explain why a sequential search would not be suitable if the array was large enough to store the names of all 2000 students in the school. [2]

(c) Give a better method of searching for a particular name, justifying your answer. [3]

12. An automatic fan is designed so that it turns on only when a person is in the room and the temperature is above a set value (V). The fan receives information from two sensors:

(a) A motion sensor which returns a value (M) dependent upon a person being sensed in the room.

(b) A thermistor (electronic thermometer) which returns the temperature in the room (T).

Write an algorithm to control the fan. [6]

13. Jobs that require printing by a network printer are stored until the printer is ready. Their addresses are placed in a queue to await their turn for printing. Addresses of new jobs are placed at one end of the queue. These job addresses are taken from the other end when the printer is ready.

(a) State **two** reasons why it would be preferable to store the queue in a linked list rather than an array. [2]

(b) If the queue is held in a linked list, describe an algorithm for:

(i) inserting an address into the queue,

(ii) reading an address from the queue. [5]

14. (a) **Three** advantages of using a relational database rather than flat files are:

(i) reduced data duplication,

(ii) improved data security,

(iii) improved data integrity.

Explain what is meant by each of these and why they are features of a relational database rather than flat files. [6]

(b) Every STUDENT in a school belongs to a CLASS. Every class has a class TUTOR and all the class tutors are teachers. Some classes have more than one class tutor although no teacher is a class tutor for more than one class. Students are identified by StudentID and each class has a unique name.

(i) Draw an entity-relationship diagram to show the relationships between the entities STUDENT, CLASS and TUTOR. [6]

(ii) Using examples taken from this application explain what is meant by:

(1) a primary key,

(2) a foreign key. [4]

End of Paper

Answers

1. **(a)**
- Collect copies of forms in use/documentation [1] because they identify many of the items of data/illustrate processes [1]
- Observe manual operations [1] because many of the procedures carried out will need to be computerised
- Interview [1] to clarify points raised by other investigation methods [1]/to clarify issues such as objectives and requirements [1]
- Use questionnaires [1] if views of a large number of people are required [1] or anonymity may lead to more truthful answers [1]

1 mark for method and 1 mark for appropriate advantage up to max of 6

(b) Diagrams could include:
- data flow diagram [1] – shows what is happening to data in the manual system [1]
- system flow chart [1] --- shows overview of new system [1]
- flowchart [1] – describes algorithm [1]
- decision tree/table [1] – for showing the possible actions to be carried out under a given set of conditions [1]
- structure chart [1] – used to express a solution tackled using a top down approach [1]
- E-R diagram [1] – shows relationships between entities/tables [1]
- HIPO chart [1] – shows overall organisation of a program [1]
- UML diagram [1] -- shows classes with attributes and methods/inheritance between classes [1]

1 mark for diagram and 1 mark for reason for inclusion up to max of 6

2. **(a)** Repeatedly
breaking a problem down
into simpler problems
until the problems can be solved easily
1 mark per point to a max of 3 [3]

(b) Modules can be kept in a library and re-used in other solutions
Many programmers can work on same problem as each can be given different modules to solve
Easier to debug as modules are small
Easier to maintain and modify as modules can be removed/added easily
Give marks in pairs, maximum 2 per pair and total max of 6 [6]

(c)
- Include comments which explain what the code is doing
- Use indentation to show blocks of code
- Use meaningful variable names so that others know what they represent
- Use a standard layout for all programs so that others can recognise what is being done easily
- Use variable names which Indicate their type such as integers start with I, floats with f, etc

Give marks in pairs, maximum 2 per pair and total max of 6 [6]

3. **(a)** syntax
Error in rules/ Grammar of language.
Spotted by translator/translator diagnostic given.

(b) logic
Error in algorithm or the applying of it.
Spotted by unexpected results being produced.

(c) arithmetic

Inappropriate arithmetic/results cannot be stored.
Either program crashes or unexpected results produced/may be spotted by translator.

4. (a)
- increased business. / no. of customers
- fewer staff required for order processing
- few mistakes in data entry
- immediate validation reduces risk of incorrect order
- reduced postal costs from mail shots
- 24 hour availability
- keep customers informed . up-to-date

[1 mark per point to max 3]

(b)
- not on-line / get internet access via ISP
- lack of skills/ user-friendly on-line ordering system
- credit card details hacked on company's computer/ firewalls and/ or passwords
- insecure communication between customer and comp[any/ encryption or digital certificates.
- email address passed on to other companies (spam)/ customer has opportunity to indicate how their email address should be used when registering / unsubscribe available

[1 mark for problem and 1 mark for solution that solves problem.]

(c) if a new customer store details
- order details validated against data held on system.
- order stored
- stock levels checked
- picking notes produced
- delivery note produced
- stock levels updated
- invoice produced

[1 mark per point up to max 3]

(d)
- include special offers and see responses
- have web links in newsletter to company website -measure hits
- part of no-line order form includes questions asking about knowledge of newsletter
- include free competition in newsletter to provoke responses
- conduct on-line survey

[1 mark per point up to max 3]

5. After the computerised system had been designed and developed, the company will need to change from using the old system to using the new one. Suggest ways in which this changeover could be managed. State the method you would recommend and give your reasons.

6a. The fetch-execute cycle:

Steps:

MAR ← [PC]	Contents of PC loaded into MAR
MDR ← [[MAR]]	Contents of address stored in MAR loaded into MDR
PC ← [PC] + 1	PC is incremented
IR ← [MDR]	Contents of MDR copied into IR
	Instruction in IR is decoded

PC stores the address of the next instruction to be executed.
MAR holds the address in memory that is currently being used.
MDR holds the data (or instruction) that is being stored in the address accessed by the MAR.
IR holds the instruction which is currently being decoded.

6b. Data bus:

- is a bi-directional path for moving data and instructions between system components
- width of the data bus is a key factor in determining overall system performance

Address bus:

- carries address of data destination
- must synchronise contents with the contents of the data bus
- width of the address bus determines the maximum possible memory capacity of the system

Control bus

- carries control signals from control unit to parts of the processor
- is a bi-directional bus meaning that signals can be carried in both directions

7a. A form-based interface:

- catalogue number entry field
- spaces for input of other identifying information (e.g. colour, quantity)
- space for the description of goods (filled in by the computer)
- spaces for computer to produce availability and price.

7bi. A command line interface is a series of commands typed at a screen prompt which give specific instructions to the computer.

ii. Advantages:

- Full range of features is available to the technician.
- An experienced user can elicit a faster response than a menu-based interface.

Disadvantages:

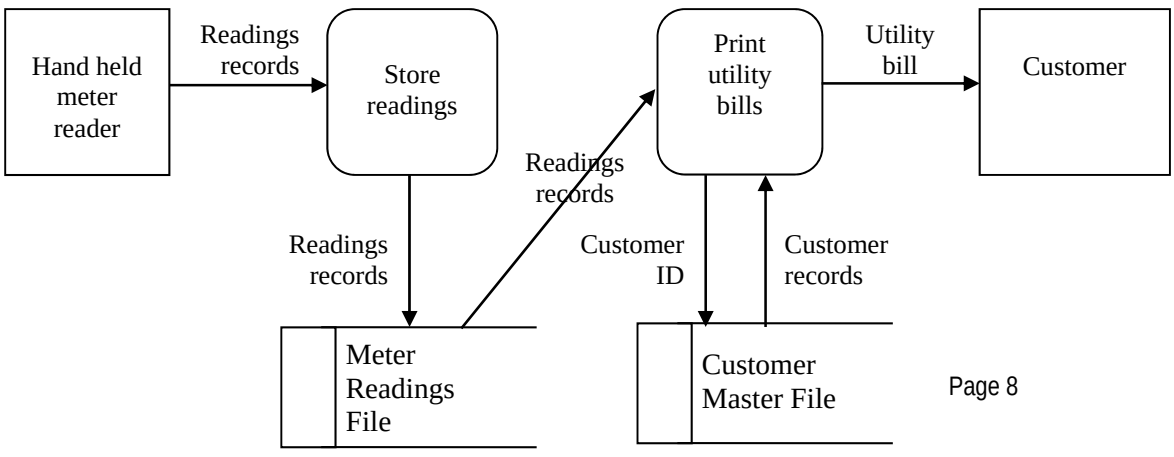
- Technician needs to learn the commands that are available.
- Needs to understand the way the system is designed so that it can be navigated efficiently.

8a. Backing up is making a copy of the entire data file in case the working file is corrupted. Archiving is taking a copy of little used data for long-term storage in case reference needs to be made to it in future. These redundant files can then be deleted in order to create space on medium.

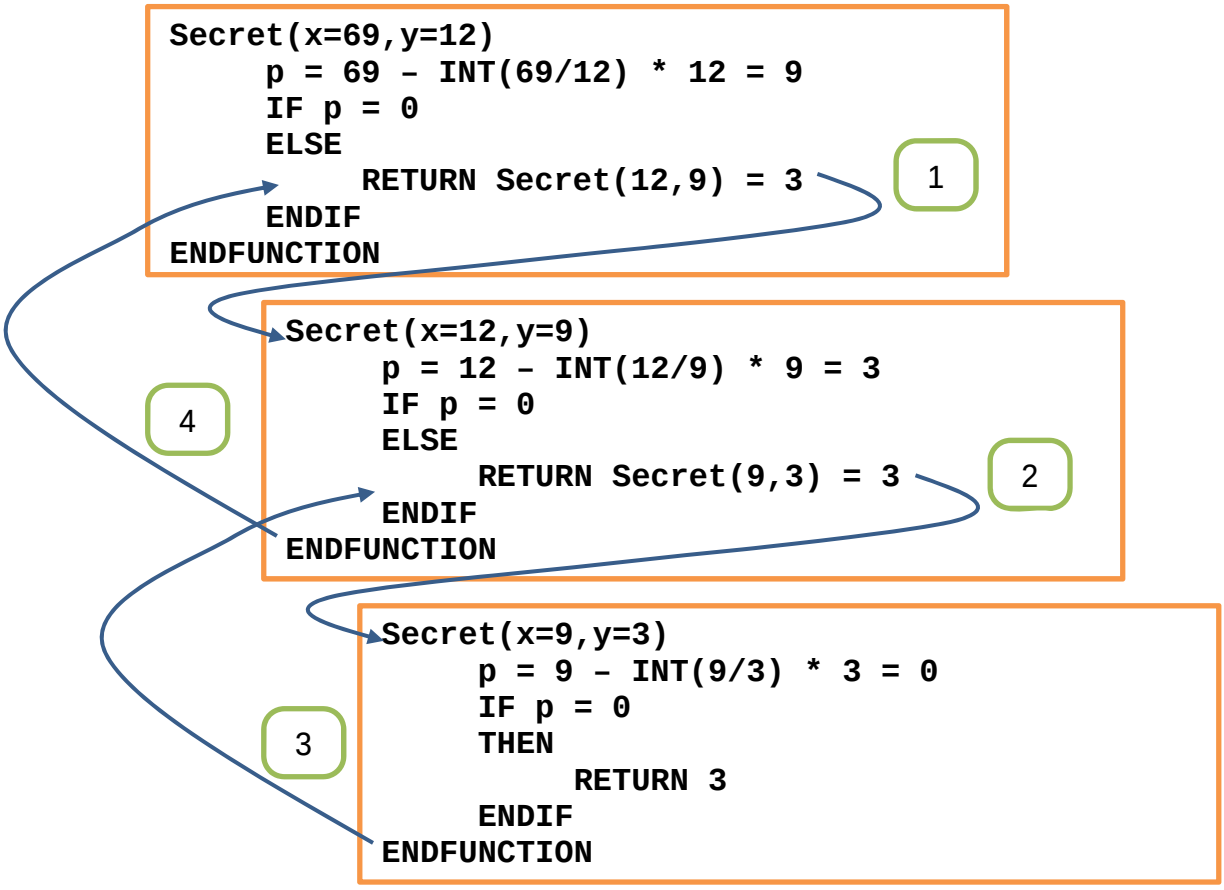
8b. Since it is an office environment where changes are frequent,

- daily backup (or at least weekly)
- copy of files to portable medium such as (portable hard disk, flash drive)
- more than one copy made
- at least one copy kept off site
- transaction log kept between backups

9.



10.



11a.

```
INPUT STUDENT
FOR COUNT = 0 TO 19
      IF ARRAY(COUNT) = STUDENT
            THEN OUTPUT "FOUND", COUNT
            END
      ENDIF
ENDFOR
OUTPUT "ERROR, NOT IN SET"
END
```

11b. Would take too long to search, because there is no indication of where to start and data is not in order.

11c. Binary search requires array to be sorted into alphabetical order

- Continual halving and take appropriate half
- mean length of search is 1000 searches for sequential search
- maximum length of search for binary search is 12 searches

Non existence in array makes the length of sequential search increase to 2000 while binary search remains at 12

12.

- loop for system switched on
- loop to wait for M to be triggered
- switch off fan in loop
- condition on temperature
- two correct outcomes: fan on and fan off
- condition to reverse current state of fan
- correct positioning of loops
- correct structure (e.g. end statements)

13a. Array may become full because of a lot of print jobs being sent together
Linked list does not needlessly take up space in memory
Print jobs may be inserted into queue in any position if they have a high priority

13bi. Find the head of the print queue
- insert data into free space
- head of list points to new node
- new node points to old first value

13bii. Find the head of the print queue
- follow pointers to null pointer
- read address of print job
- move null pointer to previous node
- return node to free space

14ai. Most items of data only need to be stored once because tables/files are linked allowing the contents of all tables to be used via access to one

14aii. Access to areas of data can be easily controlled because users each have their own view of data and DBMS can control views using access rights.
Regular backups of the data can be made automatically by the DBMS to alternative hardware

14aiii. As most information is only stored once there is less chance of contradictions being caused by the data being stored as different values
Data is protected from misguided or malicious processing/alternation leading user to trust in the correctness of the data

14bi.

14bii. Primary key ClassName (in the CLASS table) uniquely identifies each class.
Foreign key ClassName (in the STUDENT table) used to (form relationship) link to the primary key ClassName in the CLASS table.