General Certificate of Education
January 2006
Advanced Level Examination

COMPUTING **CPT5**
Unit 5   Advanced Systems Development

Tuesday 24 January 2006   9.00 am to 10.30 am

You will need no other materials.
You may use a calculator

Time allowed: 1 hour 30 minutes

Instructions
- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want marked.

Information
- The maximum mark for this paper is 65.
- The marks for questions are shown in brackets.
- The use of brand names in your answers will **not** gain credit.
- You are reminded of the need for good English and clear presentation in your answers. Quality of Written Communication will be assessed in these answers.

CPT5

Answer **all** questions in the spaces provided.

1 It is often said that correcting faults gets more and more expensive as the development cycle proceeds.

   Name **three** different types of testing that could be used in the early stages of software development.

   1..

   2..

   3..

   (3 marks)

```
___
 3
```

2 (a) Distinguish between a database and a Database Management System (DBMS).

        ....

        ....

        ....

        (2 marks)

   (b) Name the **three** levels of a DBMS.

        1 ....

        2 ....

        3 ....
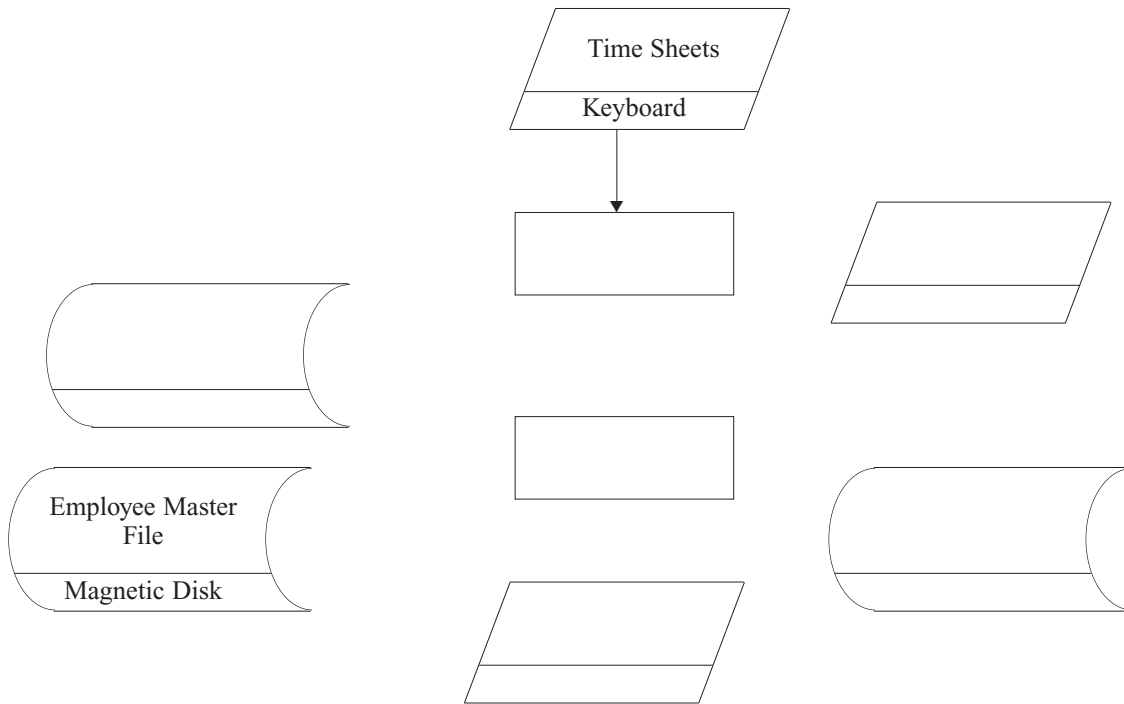
        (3 marks)

```
___
 5
```

3 In preparation of the monthly payroll run for a large company, the **time sheets** for hourly-paid employees are entered and **validated** using a key-to-disk system. The validated data is stored in a **transaction file** on magnetic disk. An **error report** is printed. The **payroll program** reads the **transaction file** and updates the **Employee Master file**, held on magnetic disk. **Payslips** are printed and the **bank transfer details** are output to magnetic tape.

(a) Compete the diagram shown in **Figure 1**.

Figure 1

(6 marks)

(b) Name this type of diagram.

....

(1 mark)

(c) (i) If the payslips are to be printed on multi-part carbonised stationery, what type of printer would be required?

....

(1 mark)

(ii) Describe the principles of operation of this type of printer.

....

....

....

....

(3 marks)

Turn over ▶

4   A head of department in a school wishes to store data on her pupils' module results for AS and A-level Computing.
The data requirements are defined as follows:

- each pupil has their forename(s) and surname recorded;
- each pupil is assigned a unique candidate number;
- each module is identified by a module code;
- each module has a given maximum number of marks available;
- each module is available each year at a winter and/or summer session;
- each pupil's module result is a number of marks between 0 and the maximum for that module;
- each pupil may resit a module several times, the best results being used to calculate the overall grade.

A single table, ResultsTable, was constructed initially in a relational database. **Figure 2** shows the structure of this table and a few entries.

Figure 2

Pupil Forenames	Pupil Surname	Candidate Number	Module Code	Exam Session	Module Mark	Level	Total Mark	Grade
Ali	Patel	1234	CPT1	W04	54	AS	187	C
			CPT1	S04	74	A	318	D
			CPT2	S04	63			
			CPT3	S04	50			
			CPT4	W05	43			
			CPT2	S05	60			
			CPT5	S05	43			
			CPT6	S05	45			
Marie Anne	Frost	1357	CPT1	W04	97	AS	255	A
			CPT2	S04	86	A	500	A
			CPT3	S04	72			
			CPT4	W05	50			
			CPT4	S05	72			
			CPT5	S05	75			
			CPT6	S05	98			
John Mark	Smith	2345	CPT1	W05	65	AS	169	D
			CPT1	S05	60			
			CPT2	S05	72			
			CPT3	S05	32			
Ali :	Patel :	7315 :	: :	: :	: :	: :	: :	: :

(a)   Which of the column heading(s) in ResultsTable would be suitable as a primary key?

....
(1 mark)

(b)   What makes this table **not** in First Normal Form?

....

....
(1 mark)

(c) When the data in **Figure 2** is stored in a fully-normalised relational database, three relations, **Pupil**, **ModuleResult** and **PupilGrade** are used. For each of these, complete the relations making sure the primary key attribute(s) are underlined.

   (i) Pupil (...)

   (2 marks)

   (ii) ModuleResult (...

   ....)

   (2 marks)

   (iii) PupilGrade (...

   ....)

   (2 marks)

(d) Complete the partial Entity-Relationship diagram in **Figure 3** to show the degree of two relationships which exist between the given entities.

Figure 3

```
┌─────────────────────┐
│                     │
│       Pupil         │
│                     │
└─────────────────────┘


┌─────────────────────┐      ┌─────────────────────┐
│                     │      │                     │
│     PupilGrade      │      │    ModuleResult     │
│                     │      │                     │
└─────────────────────┘      └─────────────────────┘
```
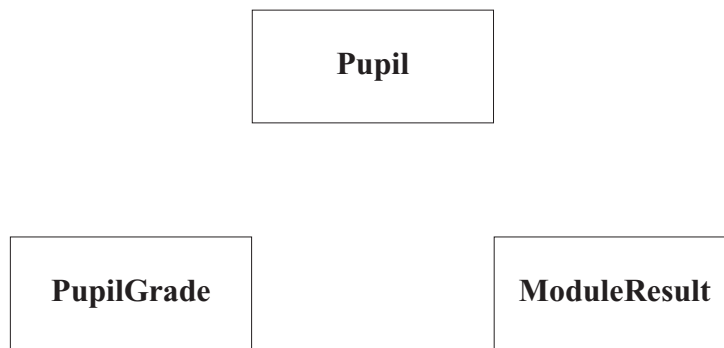
   (2 marks)

(e) Using the SQL commands SELECT, FROM, WHERE, ORDER BY and any others that you consider appropriate, write an SQL statement to query the database tables for the pupil forenames, surname and A-level grades in descending order of total mark.

   ....

   ....

   ....

   ....

   ....

   (5 marks)

Turn over ▶

5 A Local Education Authority (LEA) wants to promote healthy eating amongst the pupils in its schools.

- The cafeterias in the schools offer main meals served on plates, fruit and pre-packed sandwiches, snacks and drinks.

- When arriving at a checkout pupils must have a range of foods to provide a balanced diet.

- Any food the pupil bought earlier in the day should be considered when deciding whether the food chosen is acceptable.

Currently, the pupils keep a diary of the food they eat each day, which gets checked on a weekly basis. This is very time-consuming and the LEA decides that a computer system is to be installed in the cafeterias to aid the checking of pupils' choices.

(a) Describe **two** different fact finding techniques the systems analyst could use and how they would be applied to the above system.

1 ....

....

2 ....

....

(2 marks)

(b) Pupils in some of the schools currently use smart cards when borrowing books from their school library. In addition to computers with hard disk storage, keyboard, mouse and monitor, the systems designer has other hardware to choose from.

For each of the following, give **one** purpose of its use in this 'Healthy Eating' system.

(i) Barcode Scanner ....

....

(ii) Label printer...

....

(iii) Smart card reader/writer ....

....

(iv) Touch sensitive screen...

....

(4 marks)

(c)   When the system is ready for installation in the LEA schools, what method of conversion should be used? Justify your choice.

Method..

Justification ....

....

(2 marks)

(d)   Describe **three** tasks that have to be carried out in order to convert from the old to the new system.

1 ....

....

2 ....

....

3 ....

....

(3 marks)

11

Turn over for the next question

6 A small organisation, Acme Consultants, with four stand-alone computers in an office, want to set up a peer-to-peer network in order to share the printer connected to one of the computers.

(a) What is peer-to-peer networking?

....

....

(1 mark)

(b) If an Ethernet switch is used to set up the network, draw a labelled diagram of the physical layout of the network.

(2 marks)

(c) It is decided to set the IP addresses for each computer manually and use a subnet mask of 255.255.255.0.

(i) The following IP addresses were used for the computers:

Computer A: 192.168.5.2
Computer B: 192.168.5.3
Computer C: 192.168.4.4
Computer D: 192.168.5.5

Why is this not satisfactory?

....

(1 mark)

(ii) What should be the network ID of this network?

....

(1 mark)

(iii) What possible values could the host IDs take?

....

(1 mark)

(d) Acme Consultants now want to connect their network to the Internet using an ADSL line. A router is used to connect the network switch to the ADSL modem.

(i) What is the purpose of the router?

....

....
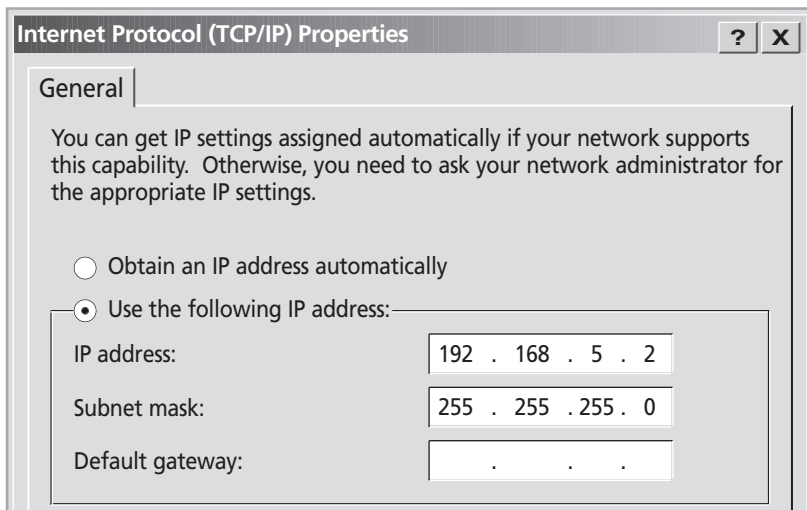
(1 mark)

(ii) The IP addresses 192.168.5.1 and 222.125.105.15 are assigned to the router. Which of the IP addresses needs to be registered with the Internet registrar and why?

IP address: ....

Reason..

....

(2 marks)

Figure 4

```
┌─────────────────────────────────────────────────────────┐
│ Internet Protocol (TCP/IP) Properties        [?] [X]      │
├─────────────────────────────────────────────────────────┤
│ ┌─General ┐                                               │
│ │                                                         │
│ │  You can get IP settings assigned automatically if your │
│ │  network supports this capability.  Otherwise, you need │
│ │  to ask your network administrator for the appropriate  │
│ │  IP settings.                                           │
│ │                                                         │
│ │   ○ Obtain an IP address automatically                  │
│ │   ◉ Use the following IP address:                       │
│ │     IP address:        192 . 168 . 5 . 2                │
│ │     Subnet mask:       255 . 255 . 255 . 0              │
│ │     Default gateway:        .    .                      │
│ │                                                         │
└─────────────────────────────────────────────────────────┘
```

(iii) **Figure 4** above shows part of the TCP/IP configuration window displayed on the monitor of computer A. What IP address should be entered for the Default gateway?

....

(1 mark)

10

Turn over ▶

7 When data is sent between two computer systems – the sender and the receiver – it is sometimes necessary to *encrypt* the data.

(a) What is encryption?

....

....

(1 mark)

(b) A digital certificate consists of a public key and a private key. Anyone can know the public key but the private key should never be disclosed by its owner, the holder of the digital certificate.

Person A and Person B want to communicate via e-mail. Each has their own digital certificate and B has previously sent a digitally signed message to A. A wants to send B a message that only B can understand.

(i) Which key should A use to encrypt this message?

....

(1 mark)

(ii) Which key does B have to use to decrypt the message?

....

(1 mark)

(c) B wants to send a reply to A.

A digital signature can be used to authenticate a message, that is, to show that it really has been sent by B and that it has not been tampered with.

B adds a digital signature to her message.

(i) List the steps needed to generate the digital signature for B's message.

....

....

....

(3 marks)

(ii) What are the steps needed to check that B's message is authentic?

....

....

....

....

....

(4 marks)

END OF QUESTIONS

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