DUNMAN HIGH SCHOOL
Preliminary Examination
Year 6

COMPUTING PAPER 2   9597

Higher 2
100 marks

24 September 2013
3 hours

Additional Materials:

Instructions: Answer all questions.

This paper consists of **6** questions.

[Turn over]

1 A company issues IT equipment on loan to its employees and currently maintains paper records of its inventory and loans.

A master inventory file contains information about all IT equipment purchased and maintained, including equipment details, current status (Available, Loaned, Damaged, Condemned), last checked date.

Loan forms containing information about loans are stored in a loan file. There are two types of loans:

- long term loan such as laptops and tablets
- short term loan such as projectors and cameras

All long term loans will be for the duration when employees are with the company. All short term loans will be for ad hoc activities. All loans need to be approved by the logistics manager and countersigned by the borrower and the issuing officer.

Damaged equipment will be sent to vendors for repairs. Repairs are also tracked in a repair log sheet. Equipment which cannot be repaired will be condemned and replaced.

At the end of the year, the company auditor requires all equipment to be returned for stock check and annual maintenance. Equipment which has reached their useful lifespan will be condemned and replaced. Equipment on long term loan will be reissued to existing employees after the annual stock check exercise. New loan forms will be issued and signed by the relevant parties.

At the start of the year, the previous year's loan forms will be archived.

The company wishes to computerise this manual system. A project manager is engaged to oversee this project. The first task which (s)he undertakes is to craft 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) Other sections of the project proposal include the proposed alternatives and evaluation. Outline **two** alternative solutions and evaluate these based on appropriate metrics. [10]

(c) The proposal is accepted and the project manager identifies the following activities with their durations and precedence relations:

Activity	Duration (weeks)	Preceding activity
A - Analysis	4	-
B - Design	3	A
C - Development	6	B
D - Testing	8	B
E - Documentation	4	C
F - Acceptance	2	D, E
G - Implementation	2	F

(i) Draw a Program Evaluation and Review Technique (PERT) chart and explain dependent and concurrent stages. [6]

(ii) State the critical path and the minimum time in which the project can be completed. [2]

(d) (i) Produce a Gantt chart based on the above information. [3]

(ii) Give **two** reasons why a Gantt chart may be preferred over a PERT chart. [2]

(e) (i) Draw a data flow diagram (DFD) to describe the current manual system. [4]

(ii) Using examples from your DFD, explain how the diagram helps to inform a database solution for the new computerised system. [4]

(f) Explain how the various testing strategies can be employed during the testing stage. [5]

2 A bank offers two types of electronic banking services to its customers:

- Internet banking through its online website
- mobile banking through a native application downloaded and installed on a smartphone

To strengthen the security of the system and protect the privacy of its customers, a 6-digit PIN is randomly generated and sent to a user's smartphone every time a user logins to access his/her account. The user has to enter his/her username and password, together with the PIN within a short time period to gain access to the system.

(a) Explain how a customer's username can be validated **before** submission to the server. [2]

(b) Explain how the password can be verified **after** submission to the server. [2]

(c) State **two** benefits of providing Internet banking through the bank's online website over mobile banking using a smartphone. [2]

(d) Give one security risk associated with mobile banking and suggest **two** ways how this can be overcome. [3]

(e) One common transaction performed by bank customers is to transfer funds from one bank account to another. The information required will be

- sender bank account number
- recipient bank account number
- transfer amount
- transaction comments

Design and justify a simple usable graphical user interface to perform a fund transfer transaction using mobile banking. You may assume that a customer may have more than one account with the bank. [4]

3 The following binary tree shows the representation of alphabets in the international Morse code:
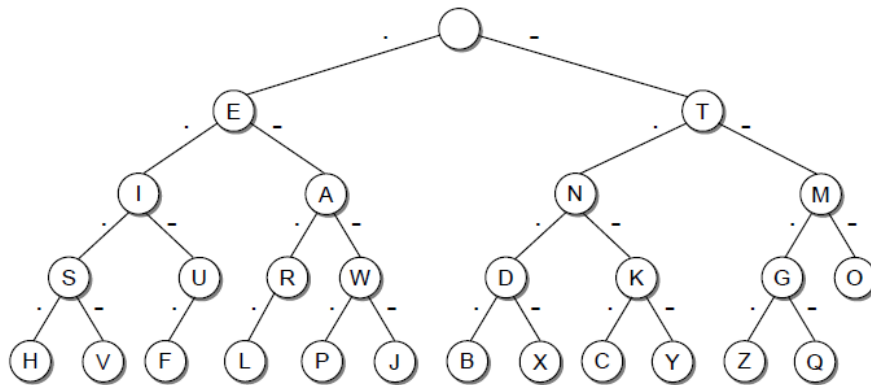
(a) Write down the Morse code for the string SOS. [1]

(b) Produce an algorithm to efficiently decode a given Morse code string. [5]

(c) Using your algorithm in (b), determine and justify if the following Morse codes are valid:

    (i) --. .- .--. [2]

    (ii) ..-. .-.- [2]

(d) Outline an efficient algorithm to include numbers as part of Morse code. Comment on the efficiency of your algorithm. [4]

4 A packet-switching network transmits data in Unicode across the Internet. Each Unicode character is defined by a 32-bit number, and is usually represented in hexadecimal. Unicode is backward compatible with the 7-bit ASCII encoding scheme which represents the English alphabet, numbers, punctuation and non-printable control characters.

(a) How many extra characters can be represented by Unicode over ASCII? [1]

(b) Give **two** advantages of using hexadecimal to represent data. [2]

(c) Errors can occur when transmitting data over a noisy network connection. Using the following data, describe a simple error-correction technique making use of modulo 10 checksum and rectify the error.

row checksum
↓

9	2	3	4	8
5	2	2	3	2
1	4	3	2	4
8	3	5	4	0
3	1	7	3	

column checksum ⟶ (bottom row)

[4]

5 An online application store maintains two types of applications: PaidApp and FreeApp. All apps have an application identification number and a number of downloads count. Paid applications require an initial purchase before they can be used and are advertisement free. Free applications can be downloaded for use immediately, but typically come with advertisements.

(a) Draw a UML class diagram to illustrate the relationship between the two types of applications. Give another method besides display()/show() which will illustrate polymorphism. [5]

(b) It is now intended to offer trial applications which are free to download but come with limited features and advertisements, with a purchase option to upgrade and unlock premium features and remove advertisements. Explain how this new application type can be incorporated in (a). [4]

(c) Discuss why object-oriented programming is a suitable paradigm to implement the online application store. [3]

6 A library provides loan of books to its members with the following conditions:

- each member can loan one or more books
- each loan may contain more than one book
- one line contains the details for the loan of a book
- a book title can appear only once in a loan
- a book title can appear on many different loans

(a) Draw an E-R diagram that will show the relationships between the entities identified. [3]

(b) Derive the third normal form (3NF) from the above specification. [3]

(c) Use appropriate examples to explain the following terms

  (i) primary key

  (ii) foreign key

  (iii) compound key

[6]

(d) Suggest **two** reasons why most cloud computing solutions do not advocate the use of relational databases. [2]

* END OF PAPER *