ST ANDREW'S JUNIOR COLLEGE

PRELIMINARY EXAMINATIONS

H2 COMPUTING **9754/02**

PAPER 2 **18 SEP 2009**

TIME: 0800 – 1030 hrs **2 ½ hours**

READ THESE INSTRUCTIONS FIRST

If you have been given an Answer Booklet, follow the instructions on the front cover of the Booklet.
Write your class and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs, music or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
Total marks for this paper is **100** marks.

This question paper consists of 4 printed pages.

Answer **all** questions.

A city council of a district has recently secured funding to allow it to upgrade the organisation's operations, technology infrastructure and processes.

One of the revamp is the standardisation of e-mail addresses of staff in the whole organisation.

1 The e-mail addresses are made up of one or more initials, followed by the surname, the @ sign, and end with **city.gov.sg**. The initials are separated from each other and from the surname by full-stops. All letters used are in lower case.

For instance, the email address of a staff member, Christopher E Hughes is

c.e.hughes@city.gov.sg

Assuming that all surnames consist of letters only, and that the minimum length of a surname is two letters, produce an appropriate Backus Naur Form (BNF) definition for the organisation's email address. [6]

2 Problems may arise for users of electronic mail on the Internet because of the danger of viruses.

(a) Describe what a **virus** is. [3]

(b) Suggest sensible precautions to take to minimise the dangers that may be caused by viruses when using electronic mail. [4]

(c) Distinguish between the integrity and the privacy of data. [2]

A system analyst was also employed to work with the management of the city council on their needs and requirements to develop a new system for the whole organisation.

3 The stages in developing a large piece of software from the initial request to the handing over of the software to the client are: (1) Problem definition, (2) Feasibility studies, (3) System analysis, (4) System design, (5) System Development, and (6) Implementation and Maintenance.

(a) Explain why this development is an iterative process. [3]

(b) The first step that the system analyst will undertake is to complete a feasibility study.

(i) Describe the purpose of a feasibility study. [3]

(ii) Describe three important tasks that he has to perform at step 5—System Development. [9]

(c) 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]

4 As part of the recommendation, a network specialist was engaged to set up a Local Area Network (LAN) within the city council building.

(a) If the network is based on a star topology draw a labelled diagram to describe the hardware of the network. [3]

(b) Justify the choice of a star network in preference to a bus network or a network using wireless communication. [4]

5 To improve the efficiency and availability of services provided by the city council such as, collection of fines, rents, maintenance fees, application for permissions and licences for business operations etc, the analyst also suggested setting up a web portal and strategic deployment of self-service payment kiosks.

(a) Besides providing information about the city council, the web portal offers online payment and application services.

(i) Discuss some potential issues that may arise with the use of the web portal by users and possible ways to resolve them. [4]

(ii) Suggest appropriate interface features that you will expect on the web pages of the web portal. [3]

(b) The self-service payment kiosk has a bar-code reader that reads the bar-codes that are printed on the payment bills and converts the information to its ASCII equivalent and displays it on the screen. A check digit is also encoded within the bar-code information on the payment bill.

(i) Explain what is meant by the term ASCII? [3]

(ii) Explain what is the purpose of a check digit and give an example to illustrate how it works. [5]

(c) Besides the bar-code reader and the display screen mentioned in part (b), suggest other appropriate input and output devices that should be available in the self-service payment kiosks. [3]

(d) Suggest some possible strategic locations for self-service payment kiosks. [2]

The management of the city council also wishes to improve the flow of traffic through the city and asked the system analyst for some suggestions.

6 The system analyst suggested the use a computer simulation of the traffic movement in the city. The simulation will be based on the current road system and traffic controls, and will be used to predict the effects of changes such as new or modified traffic lights, junction priorities or bus lanes.

(a) Explain how data on the existing traffic movement could be collected automatically and describe the hardware that would be needed. [4]

(b) Part of the simulation deals with traffic flow through a city-centre junction where five roads meet.

(i) What data would be required for this part of the simulation?
(ii) Describe how the simulation can be used to test new ideas for traffic control at the junction.
(iii) What factors might cause the predictions of the simulation to be inaccurate? [8]

(c) Explain why modular programming is sensible in writing this simulation software. [4]

(d) The modules have all been fully tested and work perfectly. However, the program fails to run. Explain why this might happen. [3]

7 The Queue Abstract Data Type (ADT) was used when writing the simulation program in Q6. The programmer decided to use a linked list to implement the Queue ADT (Assuming there is a need to maintain a free space list).

(a) Explain, with appropriate diagrams, how this Queue would operate. [4]

(b) Write the algorithm to insert a new item into the Queue. [6]

(c) If the programmer had chosen to use an array to implement the Queue ADT, describe, with appropriate illustrations, how it would look like. [4]

(d) Explain how an item can be removed from the Queue if it is implemented using arrays. [4]

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