ST ANDREW'S JUNIOR COLLEGE

H2 COMPUTING **9597**

JC2 PRELIMINARY EXAMINATIONS **28 AUG 2013**

TIME: 1400 – 1700 hrs **3 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.

1 A parcel delivery company, OOPS, is a 30- year old company that specialises in door-to-door delivery of items for its clients to various destinations locally and globally. New clients need to register with the company first before engaging its services. When a client requires a delivery to be made, the client will request via a phone call to the company. The company has decided to leverage on technology to improve their operations to deal with the stiff competition from other service providers.

(a) Assuming that you are employed as a system analyst to design and develop a computer solution for the company. State **three** methods of data collection you would embark on before designing the solution and explain what is the purpose for each of these methods. [6]

(b) During the coding phase of the development, it is common to encounter program errors. Explain the following types of program errors and why they occur,

(i) Arithmetic,
(ii) Logic. [4]

(c) One of the solutions you proposed was to create a company website that allows new clients to register and existing clients to request for delivery services through online forms.

(i) Give **three** types of input feature that you would see on the online form interface and suggest a suitable data field that needs to be captured for each input feature. [6]

(ii) Describe **two** ways to deal with possible data security threats for this online system. [4]

(d) During your investigation, you also noted that the company has a customer loyalty program that gives a range of discounts for its delivery services. For clients who have engaged the company's service for between 5 to 9 deliveries, they will receive a 5% discount. For 10 or more deliveries, clients will receive a 10% discount. If the total cumulative value for all the services engaged by a client exceed $500, the client will receive a 15% discount for delivery services. There will be no aggregation of discounts allowed.

(i) Create a decision table that shows all possible outcomes for the above loyalty program. [3]

(ii) Draw the decision table after redundancies have been removed. [3]

2 In a local university, many course modules are available for students to register. Each student is allowed to take a number of course modules for each semester, in which they will then be allocated a tutorial class. Each course module will be taught by a lecturer. A lecturer can teach several course modules.

(a) Identify the tables that will give a normalised solution for this problem. Draw an E-R diagram that shows these tables and the relationships between them. [5]

(b) Give the table descriptions for the tables specified in part (a). [5]

3 A large company has a warehouse that stores a large number of different types of electronic component parts. Each component is assigned a unique 6-digit identification code (ID). The storage location, quantity, description of the components are frequently accessed and updated.

(a) For quick access of the massive amount of stock information, one approach is to make use of a hash table to store all the information about the components.

(i) Describe an appropriate hashing algorithm for this application. [4]

(ii) Explain what is meant by collisions in the context of hash tables and explain two ways to deal with this issue. [6]

(b) Another approach is to make use of a binary search tree (BST) structure.

(i) If a sample of the components to be stored in the BST have the following IDs and are entered in that sequence, draw a suitable diagram to illustrate the contents of the BST.

156472, 168772, 154333, 162499, 172345, 143233 [2]

(ii) If there is a need to generate a printed list of all the component's information in order of the ID, write a suitable algorithm to achieve this. [3]

Assuming that the BST is implemented using three single-dimension arrays and a free space list is maintained.

(iii) If the component with ID 172345 was removed from the BST as it is no longer in production. Draw a suitable diagram to illustrate the contents of the BST for the array-based implementation. [4]

(iv) Write the algorithm that will insert a new component into the BST. [6]

(v) Describe one possible efficiency issue that this implementation may encounter and suggest a solution. [2]

(c) The company also invested in portable data entry terminals that allow the warehouse staff to perform stock checks. Information is wirelessly transmitted from the portable data entry terminals to the computer system. During transmission of digital information, there is a possibility of corruption of data,

(i) Describe one scheme that allows the detection of transmission errors. [3]

(ii) Suggest two approaches to correct transmission errors. [2]

The company has also set up a network to link up the different departments.

(d) Assuming the bus topology was used to connect up the network,

(i) Draw a suitably labelled diagram to illustrate the bus topology. [2]
(ii) State one advantage and disadvantage of the bus topology. [2]

(e) Explain the purpose of each of the following network hardware that could have been used,

(i) switch;
(ii) bridge;
(iii) router. [3]

4 You are tasked by your Programming course lecturer to read words from a text file and store the list of unique words that occur in the file. The list of words should be stored in a linked list structure and maintained in alphabetical order as each unique word is added.

(a) Using a recursive method, write an algorithm to search for a word in the list. [3]

(b) Using an iterative method, write an algorithm to insert a word into the list. [5]

(c) Differentiate between recursion and iteration. [2]

(d) If there is a need to also keep count of the number of times a word has occurred in the text, suggest the necessary modifications to any other structure and to the algorithm in part (b). [2]

5 A company has two types of employees. One type of employee is paid a monthly salary while the other is paid based on the number of hours worked.

(a) Draw suitable class diagrams and relationships to model the scheme above. You should also include appropriate attributes and methods for each class. [5]

(b) Using this example, explain the following object-oriented terms,

(i) Encapsulation,
(ii) Inheritance. [4]

6 Explain what is meant by ASCII code and Unicode. [4]

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