ST ANDREW'S JUNIOR COLLEGE

**Preliminary Examination**

**H2 COMPUTING** **9754/02**

**PAPER 2** **8 Sep 2008**

**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.

MAS Bank International is a foreign bank that has just received the licence to operate as a Qualifying Full Bank in Singapore. It has recently opened its Central Bank Office in the Central Business District and branches in the Orchard area, and hopes to expand its operations and services in Singapore.

**1** In order to better service their new clients as soon as possible, the bank will be setting up automated service lobbies in the larger housing estates. These automated service lobbies will house the automated teller machines (ATMs), cash deposit machines as well as an interactive information kiosk.

(a) Suggest **two** suitable input devices for the interactive information kiosk and explain why they are necessary. [4]

(b) The cash deposit machine accepts only three types of denominations of notes, namely ten dollar, fifty dollar and one hundred dollar notes. As each note is scanned by a special note sensor, an integer value is stored in an array in the embedded system's memory accordingly, where 1 indicates a Ten dollar note, 2 indicates a Fifty dollar note, 3 indicates a One hundred dollar note, 0 indicates an error in identifying the dollar note. There exists a function, **VERIFY**, in the program that will receive this array, the number of notes deposited and the total amount deposited as entered by the customer as input parameters and return a Boolean value to indicate a success or failure of the deposit process.

(i) What is a Boolean data type? [1]

(ii) Write, using pseudocode, the algorithm for the function VERIFY. [6]

(c) The ATM card's magnetic strip stores encoded binary information about the customer. The ATM will decode the binary information into ASCII character information for validation and display of customer information and awaits the entry of the PIN number. If the PIN number entered is correct, the ATM will access the Central Bank Office's computer system to retrieve the account details of the customer and other transactions such as cash withdrawal, fund transfer etc.

(i) Explain what is meant by ASCII character. [2]

(ii) The main computer system performs a binary search on a sorted array of customer ID which will give a direct file reference to locate the customer's details. Write the binary search algorithm that will achieve this. [5]

(iii) The ATM software uses a recursive decoding function to decode the information on the magnetic strip. Explain what is meant by a recursive function and give one disadvantage of using recursion. [3]

(d) With reference to the systems available in the automated service lobby, identify and describe,

(i) an online system,

(ii) a real-time system. [4]

**2** The bank also decides to offer its customers the opportunity to access their services over the Internet.

(a) Give **two** advantages to the

(i) customer receiving these services
(ii) bank offering these services [4]

(b) Explain why customers might be reluctant to use these particular facilities. For each problem describe how it can be solved. [4]

(c) It is important that any errors in the data sent between the customer and the bank are detected. Describe **two** methods which the computer system can use to check for errors in the transmitted data. [4]

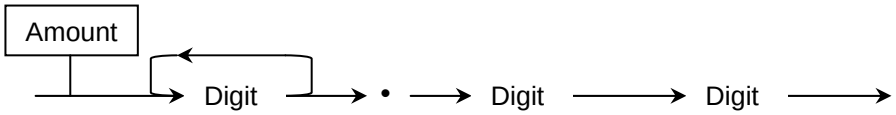
**3** The definition of a valid amount of money can be given, in Backus-Naur Form (BNF), as

< AMOUNT > ::= < INTEGER > **.** < DIGIT > < DIGIT >

< INTEGER > ::= < DIGIT > | < DIGIT > < INTEGER >

< DIGIT > ::= 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9

or as the syntax diagram:




This allows 0.35, 00.35, 002.35 to be defined as valid amounts by both methods.

A new bank manager states that no amount of money may be stored on the system which begins with a zero before the point. This means that 0.35 and 00.35 should be represented as .35 and 002.35 becomes 2.35, while an empty account is .00.

She also insists that a method be devised to distinguish between a customer owning a positive amount of money and a customer who owes some money to the bank.

(a) Using a new definition for < NON ZERO DIGIT > write the BNF rules to redefine < AMOUNT >. [5]

(b) Draw a syntax diagram for the new definition of AMOUNT. [5]

**4** Entry to the central bank office is through computer controlled doors. The environment inside the bank office is air-conditioned, making it necessary to have the doors shut as much as possible.

(a) Describe the hardware necessary to allow the computers to collect information to allow the safe operation of the doors. Your answer should refer both to times when the bank is open and closed to the public. [4]

(b) Using pseudocode, or otherwise, devise an algorithm to control the automatic doors. [8]

**5** The bank assigns a unique employee_ID to each of its employees. The master payroll file is held on magnetic tape in employee_ID order. Each week the master payroll file is updated by adding the details of any new employees, deleting ther records of employees who have left the firm and amending the records of any employees whose details have changed. This processing is done in batch mode.

(a) Explain what is meant by batch processing and why is it suitable for use in this payroll processing. [3]

(b) What error checks should be included at each stage of the processing and what actions should be taken when errors are detected. [6]

(c) Draw a **system flow-chart** for the updating process, from initial data entry to the creation of a new master file. [4]

(d) Outline the steps for the sequential updating process. [4]

**6** A financial adviser attached to the bank provides a service to about 500 clients. She makes use of about 150 investment funds, such as unit trusts and particular stocks and shares. Each client has a portfolio of investments in a number of funds, and from time to time new investments are bought and existing ones increased, reduced or sold altogether. An investment in a fund consists of a number of units. The value of the units in a fund varies, sometimes moving upwards, sometimes downwards. The frequency of these changes varies, depending on the type of fund; for most funds the financial adviser records the value of a unit each week, but for some the value is recorded each day. The cost of buying a unit is generally slightly higher than its current value, to cover administration and management costs.

The financial adviser has decided to commission a software house to produce a software package with the use of a master file to hold all the relevant data about the clients, their portfolios and the investment funds.

(a) Name four functions that would be included in this software package for the finanical adviser to manage her work. [4]

(b) Describe how the software house will test the package before releasing to the adviser. [6]

(c) Explain the need to protect the privacy and integrity of the data in the master file. [6]

The master file is very important to the financial adviser, therefore the package should also include a module that does archives and back-ups of the master file.

(d) Explain what is meant by archiving and give reasons why it would be necessary in this case. [4]

(e) Describe a sensible back-up procedure for the customer file, justifying your answer. [4]

**~~ END OF PAPER ~~**