University of KwaZulu Natal

Discipline of Electrical, Electronics & Computer Engineering

School of Engineering

UNIVERSITY OF
KWAZULU-NATAL

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Computer Methods 2 (ENEL2CM H2)

Duration   :   2 hours   Total marks :   100

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Internal Moderator   :   Prof. Jules R. Tapamo

General instructions

1. The paper consists of 8 questions. Answer **ALL** questions.
2. The paper carries a total of 100 marks
3. This is not an open book examination and no notes may be used.
4. Scientific calculators are not required

Question 1   Concepts

(a)   State the main differences between algorithms, flowcharts, and pseudo codes   .   [3]

(b)   Describe, in short, the three types of errors encountered by programmers.   [3]

Question 2   Linear structures

The radius (r) and height (h) of a closed cylinder are read from textboxes provided on a GUI.

(i)   Analyze a problem to calculate the surface area of the cylinder using the formula:

$$A=2\pi r^2+2\pi rh.$$ [3]

(ii)   Code a sub program in which the surface area of a cylinder is calculated.   [4]

Question 3   Conditional structures

(a)   ApliSoft Trading manufactures 32GB memory sticks. Retailers reject consignments when the average capacity of memory sticks in a consignment is below 31GB. However retailers may agree to pay an extra amount when the average capacity of memory sticks in a consignment is above 33GB. Otherwise, standard rates are paid. A program is required which accepts the average capacity of memory sticks in a consignment. The program then displays an amount to be paid for the consignment based on the following information. Standards rates are R1500 per consignment. An extra R500 is paid for every extra GB after 33GB. A rejected consignment is not paid for.

(i)   Analyze and give a sketch drawing of a suitable interface for solving this problem.   [2]

(ii)   Draw a flowchart for designing the solution to this problem.   [4]

(iii)   Interpret your flowchart design into VB codes to the OK button.   [4]

(b)   ApliSoft Trading handles their consignments by putting together memory sticks in batches based on their average capacity. Memory sticks whose average capacity range from 1GB and 10GB are batched and donated for free. Those whose average capacity is 20, 25, or 30 are batched and sold to staff. Memory sticks whose average capacity are above 30 but not more than or equal to 31 are exported. Memory sticks whose average capacity is above 31GB are sold to retailers. The rest are shared among the bosses. Using the SELECT – CASE statement, code a VB subroutine which accepts an average capacity of a batch of memory sticks, and display the appropriate action in a message box.   [5]

Question 4　　Loops

(a)　Distinguish between the three main looping constructs used in VB. In each case, give the general syntax of the construct and state its unique feature　　　　　　　　　　[6]

(b)　The value of π can be estimated using Stirling's formula as follows:

$$\pi = \frac{4}{1} - \frac{4}{3} + \frac{4}{5} - \frac{4}{7} + \frac{4}{9} - \frac{4}{11} + \cdots + \frac{4}{2n-1}$$

If a program accepts a large value of n through an inputBox:

(i)　Design a flowchart to approximate the value of π using Stirling's views　　[4]

(ii)　Using a suitable looping construct, interpret your designs into VB codes.　　[5]

Question 5　　Arrays

(a)　What mainly distinguishes an array from a variable?　　　　　　　　　　[1]

(b)　A linear array of 20 random integers between 30 and 50 is required.

(i)　Declare the array and write codes to populate the same array with appropriate values.　[5]

(ii)　Write codes to sort the array in ascending order　　　　　　　　　　[4]

Question 6　String Manipulation

(a)　Suppose you are given a paragraph String as a parameter input. Write separate VB functions to:

(i)　determine the number of words in the paragraph　　　　　　　　　　[2]

(ii)　determine the percentage of digits in the paragraph.　　　　　　　　　[3]

(b)　A Cuban car registration number has 10 characters, e.g. MAT-14-728. The three letters indicate the province in which the car is registered, e.g. Matanzas. The first two digits indicate the year in which the car was first registered. All cars on the road were registered after the year 2000. The last three digits indicate the category of vehicle. Write a subroutine which accepts a Cuban car registration number as a parameter and determines the age of the car.　　　　　[5]

Question 7   Subroutines, Subs, and Functions

(a)   The main purpose of subroutines, subs, and functions is to break programs into smaller chunks. State three advantages of breaking program into smaller pieces.   [3]

(b)   In what way does a function differ from a sub?   [1]

(c)   The following problem of choosing *r* items from *n* possibilities can be solved using functions and subroutines. The following formula guides the computations thereof: $^{n}C_r = \frac{n!}{r!(n-r)!}$. If the driver subroutine is defined as follows:

> *Sub btnOk()*
>   *Dim n, r As integer*
>   *n = ---------*   *REM complete by taking n from a textbox*
>   *r = ---------*   *REM complete by taking r from a textbox*
>   *txtComb.text = str (comb (n,r))*
>   *end sub*

     (i)   Complete the implementation in the driver subroutine   [2]

     (ii)   Code a function called *fact ()* which accepts one integer parameter and calculates/returns the factorial of that parameter.   [4]

     (iii)   Code a function *comb( )*, called by the driver subroutine, which accepts two integer parameters and calls *fact ()* three times towards computing the required combinations.[5]

Question 8   Structures, Objects, and Classes

(a)   In object oriented programming, what is the main purpose of a constructor?   [1]

(b)   An internet cafe keeps record of people who access the net in their shop. For each person, a *surname*, and *timeOnNet* (in hours) are recorded. Each person who comes to the shop is allocated a particular PC to use. For each PC, the *serial number* and *book value* are recorded. Using objects, classes, subs, and functions:

     (i)   Define a class called PEOPLE. The class globally defines a structure called PERSON which encapsulates three fields (*surname, timeOnNet,* and *charge*). In the same class, develop a sub program called getPersonData, which uses a globally declared record of the type PERSON, to enter the *surname* and *timeOnNet* using inputBoxes. The *charge* field will be populated later.   [5]

     (ii)   Define a class called COMPUTER. The class globally defines a structure called PC which encapsulates three fields as well, namely: *serial number, book value*, and *ageComment*. In this class, develop a sub program called getPCData, which uses a

globally declared record of the type PC to enter the *serial number* and *book value* using inputBoxes. The *ageComment* field will be populated later. [5]

(iii) In the PEOPLE's class, add a subroutine to determine and populate the *charge* field. The charge for using the net is calculated as a product of *timeOnNet* and a rate per hour based on the time spent. If *timeOnNet* is above 2 hours, a rate per hour of R25 is used. Otherwise a higher rate per hour of R30 is used. [4]

(iv) In the COMPUTER's class, add a subroutine to determine the ageComment. The comment is "NEW" when a PC has a book value above R10,000.00. Otherwise the ageComment is "OLD". [3]

(v) Your driver class declares and instantiates two objects, one of the type PEOPLE and another of the type COMPUTER. Sub btnOK ( ) calls *getPersonData ( )*, *getPCData ( )*, and displays the person's *charge* and the PC's *ageComment* in separate message boxes. Charge and ageComment must be retrieved from related records [4]

END OF EXAMINATION