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CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

INFORMATION TECHNOLOGY

Paper 02 – General Proficiency

INFORMATION PROCESSING PROGRAMMING

2 hours

19 MAY 2005 (a.m.)

INSTRUCTIONS TO CANDIDATES

1. **Number EACH answer correctly in your answer booklet.**
2. **Begin EACH answer on a new page.**
3. **This paper consist of TWO sections, Section I and Section II.**
4. **Candidates must attempt the first question in EACH section and chose TWO other questions from EACH section.**

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

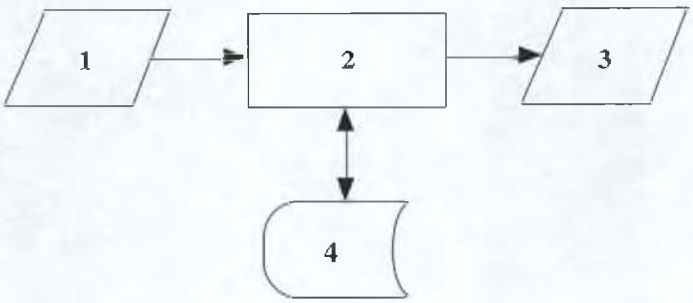
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SECTION I

INFORMATION PROCESSING

Answer Question 1 and any TWO other questions from this section.

1. (a) Write the appropriate term for EACH of the numbered icons in the diagram below:



(4 marks)

(b) Transactions involve adding a new record to, or deleting a record from, and updating an existing record in the master file. Consider the following primary keys in the master file and transaction file:

Master file: 0101, 0104, 0105, 0107, 0110
Transaction file: 0101, 0103, 0106, 0107, 0110

(i) Describe the concept of a 'transaction'. **(2 marks)**

(ii) List the records which are to be inserted and/or deleted from the master file. **(4 marks)**

(iii) Write the keys of the master and transactions files after the processing of the records. **(2 marks)**

(iv) Transactions can be validated as they are keyed by the operator. Explain the purpose of validation. **(1 mark)**

(v) In a batch processing environment, explain what problems can occur if the transaction file is NOT sorted. **(2 marks)**

(vi) State the names of the master file and transaction file after processing is completed. **(2 marks)**

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(c) You wish to conduct a house-to-house survey in your area of 1500 persons. This data needs to be collected, keyed in, and stored to disk.

(i) Identify TWO ways in which the data collected may be inaccurate. **(2 marks)**

(ii) Explain why double data entry may be necessary. **(2 marks)**

(iii) Name and describe TWO checks that will ensure that the data is entered correctly. **(4 marks)**

(iv) It was decided to have each person's name pre-printed on a form along with the questions. Then the responses were coded on the form and processed by the computer.

Give the name given to this type of machine-readable document. **(1 mark)**

(v) Give ONE advantage of the method used in c (iv). **(1 mark)**

Total 27 marks

2. (a) The Hurricane Centre receives coded data in a sequence to be interpreted by computer. In any one day, the centre may send individual lines of code with updated data. The data is received in the following format:

Three-digit advisory number - date - Name of storm - latitude - longitude - sender's initials - !

Note that a dash separates each code.
The three-digit advisory number is unique and sequential.
The sender's initials are always two letters long.

(i) Give TWO reasons for the inclusion of the three-digit advisory number. **(2 marks)**

(ii) Explain why the exclamation point (!) is required. **(1 mark)**

(iii) Write ONE sentence giving details on the following data received:

245-05212005-Vanessa-45.3-56.4-HE! **(4 marks)**

(iv) The following data was received in sequence. State which sender is sending erroneous data and correct the errors:

343-21012005-Eric-45.3-56.4-HE-!
334-01212005-Eric-56.5-45.4-GJ-!
345-21012005-Eric-45.6-56.7-AE-! **(3 marks)**

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(v) Give TWO *other* rules that should be stated on the format of the code. **(2 marks)**

(vi) Explain whether batch, interactive, or on-line would be the BEST method of receiving this data. **(1 mark)**

(vii) Explain your reasons for NOT choosing the other two methods in (vi) above. **(2 marks)**

(b) Consider the following list of primary keys:

List1: 55, 34, 45, 39, 51, 48, 59
List2: 34, 39, 45, 48, 51, 55, 59

(i) Explain the difference between serial and sequential order. **(2 marks)**

(ii) State which of the lists in b (i) is ordered serially or sequentially. **(2 marks)**

(iii) Re-write the TWO lists after inserting key 50. **(2 marks)**

(iv) The key 51 needs to be deleted. For EACH list, explain if access would be faster, slower or the same. **(1 mark)**

(v) For EACH list, explain if access would be faster, slower OR the same if ALL of the keys were read. **(2 marks)**

Total 24 marks

3. (a) Illustrate the difference between a data flow diagram and a data dictionary.
(4 marks)

(b) Create a decision table to represent the following scenario:

If a customer's credit rating is good and the item ordered is in stock, then confirm the order, but if the item is not in stock then do not confirm the order. If the customer's credit rating is not good however, whether the item is in stock or not, the order is not confirmed. **(7 marks)**

(c) The systems development life cycle includes the following:

- Both the coding and testing of the system
- The acquisition of hardware
- The installation of the new system or conversion of the old system to the new one

(i) State the phase of the systems development life cycle that includes these activities. **(1 mark)**

(ii) Explain TWO types of testing strategies that are used in the testing of the system.
(2 marks)

(iii) Describe ONE advantage and ONE disadvantage involved in the acquisition and installation of hardware. **(2 marks)**

(iv) Describe the difference between the phased implementation and parallel running methods used in the conversion from the old system to the new system.
(2 marks)

(v) State ONE disadvantage of the phased implementation and ONE disadvantage of the parallel running methods. **(2 marks)**

(vi) Name and describe TWO other phases in the systems development life cycle.
(4 marks)

Total 24 marks

4. (a) A segment of an assembly language program is written as follows:

```
LDA 7     – load the value 7 into the accumulator
STA val1  – store the accumulator value in the location val1
LDA 8     – load the value 8 into the accumulator
ADD val1  – val1 and accumulator value are added and the answer stored in
            accumulator
STA val2  – store the accumulator value in location val2
SUB 3     – subtract the value 3 from the accumulator value
ADD val2  – add val2 to accumulator value and store in accumulator
STOP      – stop the program
```

Rewrite EACH line in the program above, showing the result of val1, val2 and the accumulator. **(8 marks)**

(b) Convert the following two's complement binary values to decimal values:

(i) 00001111_2 **(1 mark)**

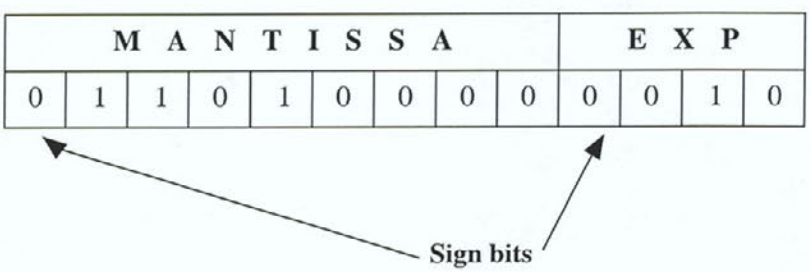
(ii) 11110001_2 **(2 marks)**

(c) Give the result of $00011101_2 - 19_{10}$ in binary representation. **(2 marks)**

(d) In the diagram below, eight bits of the mantissa are used to form a binary fraction of a normalized expression. The exponent is a whole number with the sign bits indicated.

(i) What is the value in base 10 of the positive, non-integer number written below? **(4 marks)**

(ii) Using this same type of representation, how would the number 26_{10} be written? **(3 marks)**



(e) One of the computers in the school is designed with a word length of 16 bits. The operational codes are held in three bits.

(i) What is the maximum number of directly addressable locations available? **(2 marks)**

(ii) How many different operation codes would this computer be capable of using? **(2 marks)**

Total 24 marks

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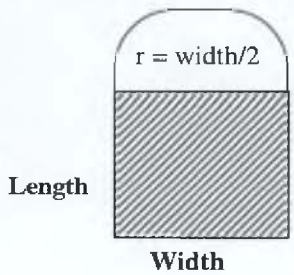
SECTION II

PROGRAMMING

Attempt QUESTION 5 and any TWO other questions in this section.

Programs may be written in Basic or Pascal or C.

5. A wall piece is constructed by combining a rectangular piece of wood with a **semi circular** piece of glass on top. The structure is lined with a strip of metal that runs the entire perimeter of the structure.



Mahogany costs $12.00 per square foot, Cedar costs $10.00 per square foot, glass costs $15.00 per square foot and the metal costs $2.00 per foot.

The formulas are as follows:

The area of a circle = πr^2
The area of a rectangle = length * width
The perimeter of the circle = $2\pi r$
$\pi = pi = 3.14$

You wish to write a program that will calculate the cost of the structure.

(a) State the programming language that you would use to write this program. **(1 mark)**

Using the programming language stated in (a), write programming statements for each of the following:

(b) Using FOUR separate statements prompt the user for and accept the length and width of the rectangle in feet. **(4 marks)**

(c) Allow the user to choose EITHER mahogany OR cedar wood. Based on the choice made, use the appropriate value for the cost of the wood. **(4 marks)**

(d) The radius (r) is a half of the width of the rectangle. **(1 mark)**

(e) Using the formulae provided on page 7, calculate

(i) the area of wood needed **(1 mark)**

(ii) the cost of the wood needed **(1 mark)**

(iii) the area of glass needed **(1 mark)**

(iv) the cost of the glass needed **(1 mark)**

(v) the length of metal needed (half the perimeter of the circle added to the lengths of the three exposed sides of the rectangle) **(2 marks)**

(vi) the cost of the metal needed. **(1 mark)**

(f) Calculate the total cost of all materials. **(1 mark)**

(g) Labor is 25% of the cost of materials. Calculate the total cost of the finished wall piece. **(1 mark)**

(h) Print a statement showing the amount of wood used and the cost of the wood (eg: "Wood used: 30 sq feet – cost: $360.00"). **(2 marks)**

(i) Print a blank line. **(1 mark)**

(j) Print the statement "The cost of the wall piece is: " followed by the calculated value your program generates as the total cost. **(2 marks)**

(k) Declare any constants which were required at the beginning of the program. **(1 mark)**

(l) Declare the variables which were required at the beginning of the program. **(2 marks)**

Total 27 marks

6. (a) A local computer company has 4 categories of employees: Executive, managers, clerks and maintenance workers.

- Executives are paid twice as much as clerks
- Managers are paid 25% more than clerks and
- Maintenance workers are paid half the salary of managers.

Write a program that will calculate the salary each category of worker makes per week and the total amount of money spent on salaries weekly.

Assume the variables SalaryC, SalaryE, SalaryM and SalaryW contain the salary amount for the executive, managers, clerks and maintenance workers respectively.

Your program should do the following:

(i) Allow the user to input the number of workers in each of the four categories.

(ii) Calculate the salary of each category of employee and the total salary paid.

(iii) Write a print statement for the total salary. **(16 marks)**

(b) Obadiah has developed a simple method of encrypting his pin number. He allows you to input the value 1275. Trace the program to find his secret code, writing the values for num and Val.

```
Program SecretPin;
Begin
      output("Input a four digit number");  Prompt for the value
      input (num);                          The value 1275 is read
      Divdr = 1000;
      i = 1;

      While i < 5 do
{     Val[i] = num/divdr;                   Only whole number returned
      num = num%divdr;                      Only remainder returned

      i = i +1;
      divdr = divdr/10;
}

For (j = 1) to (j = 4) do
      If (Val[j] <=6)
            Val[j] = Val[j]+10;
      Else
            Val[j] = Val[j]

For (j = 1) to (j = 4) do
{     Val[j] = Val[j] –7;
      output (num,Val[j]);
}
End.
```

(8 marks)

Total 24 marks

7. (a) Consider the following algorithm:

```
Initialize variables s, sides, length, cost
s =2
Cost = 20.5
Output 'Enter length'
Input length
Price = cost x length x 10 x s
Output 'The cost is, cost'
```

(i) Explain why it is NOT good to use variables such as s, in an algorithm. **(1 mark)**

(ii) Using a programming language BASIC, Pascal or C (or a specified language of your choice), convert the above algorithm to a program. **(7 marks)**

(iii) State the result of the program when length = 2. **(1 mark)**

(b) Explain the difference between

(i) 'testing' and 'debugging' an algorithm **(2 marks)**

(ii) 'unit testing' and 'integration testing' **(2 marks)**

(iii) 'user documentation' and 'program documentation'. **(2 marks)**

(c) The following segment of program code has a flaw. The code was to calculate the sum and average of five even numbers ranging from 2 to 10.

(i) State the line number where you find an error and write the correct code. **(4 marks)**

```
1     ...
2     i = 1;
3     j = 2;
4     sum = 0;

5     While i >1 do
6     {
7     sum  = sum + j;
8     j = j + 2;
9     }
10    avg = sum;
```

(ii) Copy and complete the trace table for the corrected algorithm.

(4 marks)

(iii) Write the result of the corrected algorithm. **(1 mark)**

i	j	sum
1	2	2

Total 24 marks

8. (a) The following program segment multiplies two values, adds a third value to their product and then stores the final result as a fourth value.

LOAD	***W***
MULT	***V***
ADD	***P***
STORE	***X***

(i) State the programming language used. **(1 mark)**

(ii) If W = 2, V = 7 and P = 3, determine the value stored in X. **(1 mark)**

(iii) Rewrite this segment of code in a programming language of your choice. You may assume that variables have been declared. **(5 marks)**

(b) In Country C, on a small, man-made island, the life expectancy (LE) for a male child at birth is 20 years more than half the age of his father. The life expectancy (LE) for a female child at birth is 30 years more than one-third the age of her father. Write the pseudo code of a program that will:

(i) Declare variables to hold life expectancy values for a female child and a male child. **(2 marks)**

(ii) Declare a variable to hold the father's age at the time of the child's birth. **(1 mark)**

(iii) Declare a variable to hold the gender of the child as either an "F" for female or an "M" for male. **(1 mark)**

(iv) Prompt for the gender of the child. **(1 mark)**

(v) Accept the gender of the child. **(1 mark)**

(vi) If the child is a male, calculate his life expectancy (LE) using the appropriate information provided. Otherwise, calculate the life expectancy of the female child using the other part of the information provided. Use an IF-Then-Else statement to do this. **(5 marks)**

(vii) Print the LE of the child. **(1 mark)**

(c) Show the output of the following program segment using a trace table.
Note that ***r mod 2 = 0*** indicates that the value zero (0) is the remainder of the division of the number ***2*** into the value ***r***. **(5 marks)**

```
Begin
        r = 1;
        y = 5;

        While r < 5
        begin
                If (r mod 2 = 0) then
                        write  r
                Else
                        write y
                r = r + 1;
                y = y – 1;
        end;
End.
```

Total 24 marks

END OF TEST