S'06 : 2 FN : AN 203/AD 303 (1403)

COMPUTING AND INFORMATICS

Time : Three hours

Maximum marks : 100

Answer FIVE *questions, taking* ANY TWO *from* **Group A,**
ANY TWO *from* **Group B** *and* ALL *from* **Group C.**

*All parts of a question (a, b, etc.) should be
answered at one place.*

*Answer should be brief and to-the-point and be supple-
mented with neat sketches. Unnecessary long answers
may result in loss of marks.*

*Any missing data or wrong data may be assumed suitably
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Figures on the right-hand side margin indicate full marks.

Group A

1. (*a*) Write a single C^{++} statement that subtracts the sum
    of x and y from z and then incrementing.   3

   (*b*) An electricity board charges the following rates from
    domestic users to discourage high consumption of
    energy :
    For first 100 units— 60 paise per unit
    For next 200 units— 80 paise per unit
    Beyond 300 units— 90 paise per unit.
    All users are charged a minimum of Rs. 50. If the total
    amount is more than Rs. 300, then an additional sur-
    charge of 15% is added. Write a C^{++} program to read
    the names of users and number of units consumed
    and print out the charges with names. Clearly specify
    all data types.   17

(Turn Over)

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2. (a) Write a macro in C^{++} that obtains the largest of 3 integers. 3

(b) Write a C^{++} function power( ) to raise a number m to a power n. The function takes a double value for m and int value for n, and returns the result correctly. Use a default value of 2 for n to move the function to calculate squares when this argument is omitted. 7

(c) Write another C^{++} function that performs the same operation as the previous function in question 2(b) but takes an n int value for m. Both the functions should have the same name. Write a main that calls both the functions. Use the concept of function overloading. 7+3

3. (a) Specify an algorithm in English like pseudo code that can be used to merge two sorted integer arrays A and B of size M and N elements, respectively into a simple sorted array e. Assume that all the arrays possess elements arranged in ascending order. 10

(b) Write a C^{++} function that takes as parameter an array of n integers $A[n]$ and another integer X and returns a pointer to the index of the very first occurrence of X in the array. $A[n]$ of X is present in the array, otherwise it returns NULL. 10

4. (a) Mention about various different network topologies in existence along with the schematic for each as well as their advantages and disadvantages. 12

(b) Specify an outline of the Data Flow Diagram (DFD) that can represent the encashing process of a cheque in a bank. 8

AN 2(\D 303 (1403)   (2)   (Continued)

Group B

5. (a) Specify the organisational structure of a modern-day computer consisting of the following components : 10

(i) A 32 bit CPU with 32 bit Data and Address Bus

(ii) A 256 KByte cache memory

(iii) A 512 MByte main memory

(iv) A 806 B Hard Disk Drive

(v) A Keyboard

(vi) A Printer.

(b) What are the basic characteristics of a uniprocessor based, multitasking operating system? Specify a typical process state diagram for such an operating system. 4+6

6. (a) Construct a 1 bit Half Adder that accepts two 1 bit operand a_i and b_i and produces the carry out c_i and the summation s_i. Use optimum number of gates. 10

(b) Specify the structure of a J-K flip-flop using R-S flip-flop. 4

(c) What are the advantages of a Master Slave J-K flip-flop? How can it be built using ordinary J-K flip-flop and associated logic gates? 3+3

7. (a) What are different types of file organisations used in contemporary file systems in modern-day operating system? Explain with examples. 12

(b) What are different passes of a compiler? What are their relationships? Explain by appropriate schematic diagram. 4+4

AN 203/AD 303 (1403)   (3)   (Turn Over)

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2

8. (a) Perform the specified operation with the operands as specified below :

$82A2FE_{16} - 124879_{10}$ using 2's complement binary. You must first convert each operand into their equivalent 2's complement Binary notation. Show all steps. $3 \times 2 + 2$

(b) What is a virtual memory ? What are the necessary layers of memory hierarchy that helps to create the virtual memory ? How is paged segment memory management feature of an operating system utilizes those layers to implement the virtual memory ? $2+3+7$

Group C

9. Justify or contradict each of the following statements with proper justification in each case. No credit for merely specifying *Yes/No* or *True/False* : 2×10

(i) Pentium is a 32 bit machine because it has got a 32 bit Address Bus.

(ii) Unix is a multiuser operating system.

(iii) C is a procedural programming language.

(iv) A C^{++} compiler actually translates a C^{++} source code into the equivalent machine code of the target CPU.

(v) Operating system acts as a resource manager for any computer system.

(vi) When one needs to connect all the computers in one building, then it is preferable to use a LAN.

(vii) TCP/IP is actually two protocols rolled into one.

(viii) If is a valid C^{++} identifier.

(ix) A-23 is a valid C^{++} constant.

(x) Flash memory is a writable non-volatile memory.

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Group A

1. (*a*) Write a C function to take as arguments three real numbers and return true if sum of any two numbers supplied as arguments is greater than the third. Use the function in a program to test if three numbers read from the keyboard form the sides of a valid triangle.   8

   (*b*) Principal amount P invested for n years returns an amount A given by

   $$A = P(1 + r/100)^n$$

   where r is the percent rate of interest. Write a program to display the amount to be received when Rs. 5000 is invested for 2, 3, 4 and 5 years at rate of interest of 10%.   8

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4

(c) Explain the following C statement:

$$x = (a > 4) ? 5 : 6;$$ 4

(a) What is data hiding in a program? How is it implemented in C^{++}?   10

(b) The following program defines a class rectangle to store length and breadth of a rectangle:

```
Class Rectangle
    {
        private:
            float length
            float breadth
        public:
            Rectangle ( ) { }
            Rectangle (float l, float b)
                {
                    length = l;
                    breadth = b;
                }
            void show data ( )
                {
                    cout <<"length ="<<length
                         <<"breadth ="<<breadth
                         <<endl;
                }
    };
```

Modify the program to add

(i) a function to return the area of the rectangle;

(ii) overload operator function (= =) to compare two rectangles and return true if they are identical.   5+5

(a) Distinguish between a text file and a binary file.   4

(b) Write a program to read the roll numbers and names of a set of students from the keyboard and write the same to a file.   8

(c) Write a program to read the roll number of a student and display his name, if found in the file.   8

4. (a) What is a modem? Describe its role in data communication.   10

(b) What is multiplexing? Distinguish between frequency division and time division multiplexing.   10

Group B

5. (a) What is the range of integer numbers a computer system can store if it reserves two bytes for storing an integer number?   8

(b) Show truth table for Boolean expression $E = A'C' + BC'$.   6

(c) Draw a logic circuit to implement the above relation.   6

6. (a) Describe the use of following input devices: 6+6

(i) Magnetic Ink Character Reader (MICR); and

(ii) Optical Mark Reader (OMR).

(b) What is a line printer? How does it differ from a dot matrix printer?   8

7. (a) Describe the role of the following in the architecture of the RAM of a computer:

(i) Address lines

(ii) Data lines

(iii) Control lines.   10

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(b) How will you perform the following tasks under DOS and Windows environment?

(i) Create a subdirectory for storing files;

(ii) Format a floppy disk;

(iii) Copy a file from the hard disk to a floppy disk; and

(iv) Search the hard disk for a specific file.

8. (a) What is transaction processing in industry? Describe the role of computer network in keeping track of transaction.   10

(b) What is a database? Describe the advantages of a centralized database over separate files for specific applications.   10

Group C

9. Answer the following: 10×2

(i) The following code is illegal: Why?
```
int k = 20;
float x [ k ];
```

(ii) Which of the following are not C^{++} keywords?
public, switch, double, cin, for, object, static.

(iii) The following statement opens a file named "myfile" for writing
```
FILE * fptr;
fptr = fopen ("myfile", "w");
```
How will you check that the file has been successfully opened?

(iv) How is an interpreter different from a compiler?

(v) How is assembly language different from machine language?

(vi) What is distributive law of Boolean algebra? Use the law to prove that $A + A'B = A + B$.

(vii) What is meant by a protocol in computer communication?

(viii) In data transmission through internet, are data packets received at the destination in the same order in which they were transmitted?

(ix) What is meant by BIOS?

(x) What is the decimal equivalent of hexadecimal number $(2BOA)_{16}$?

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COMPUTING AND INFORMATICS

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Group A

1. (a) With reference to object oriented programming
(OOP), explain the terms (i) encapsulation, and
(ii) abstraction.   2 + 2

(b) Differentiate between (i) function overloading,
and (ii) function overriding.   2 + 2

(c) Write a C⁺⁺ program which will determine whether
an input number is prime or not ?   6

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(*d*) A phone number, such as (212) 767-8900, can be thought of as having three parts : the area code (212), the exchange (767), and the number (8900). Write a C⁺ program that uses structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this :

    Enter your area code, exchange and number :

    415 555 1212

My number is (212) 769-8900

Your number is (415) 555-1212.   6

2. (*a*) Write a swap () function which exchanges two floating point values of x and y. Test this function for $a = 22 \cdot 2$ and $b = 44 \cdot 4$ as input and write down the corresponding output.   6

  (*b*) Write a program that reads 5 numbers in an array and then print them in reverse order. The numbers are floating point values.   6

  (*c*) What is meant by the term 'system' ? What are the characteristics and categories of information system ? Briefly discuss them.   8

3. (*a*) With reference to ISO/OSI model, explain following terms :   2 × 4

    (*i*) Entity

    (*ii*) Protocol

    (*iii*) ISP

    (*iv*) Message

(*b*) A LAN network using CSMA/CD has a bandwidth of 10 Mbps. If the maximum propagation time (including the delays) is 25·6 µsec, what is the minimum size of the frame ?   4

(*c*) What is LAN ? What is IEEE standards for LAN ? Describe them briefly with a neat diagram.   8

4. (*a*) What is email ? Define and briefly explain the terms : (*i*) Mail box, (*ii*) User agent, and (*iii*) Message transfer agents, in relation to email services.   2 × 4

(*b*) What is meant by process-to-process delivery in transport layer ? How can this be achieved through client-server technology ?   6

(*c*) What is TCP/IP protocol suite ? How many layers are there in TCP/IP ? Draw a neat diagram and briefly describe them.   6

Group B

5. (*a*) Convert the following from one number system to another :   2 × 5

    (*i*) $(1357)_{10} = (\quad)_2$

    (*ii*) $(1463)_{10} = (\quad)_8$

    (*iii*) $(1010010110)_2 = (\quad)_{16}$

    (*iv*) $(573)_8 = (\quad)_{16}$

    (*v*) $(1100100110)_2 = (\quad)_8$

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(b) Explain briefly the following: 2 × 3

    (i) Object program

    (ii) Use of BIOS

    (iii) Interpreter.

(c) What are the functions of an operating system? Briefly explain them. Also, give name of *any two* OS known to you.   4

6. (a) What is DBMS? What is the primary goal of DBMS? Describe briefly with applications.   8

    (b) How an EX-NOR gate works? What is its truth table?   6

    (c) What is a JK flip-flop? Write the truth table and show how it can be converted into a T-flip-flop.   6

7. (a) What is meant by information systems? How is strategic information system useful for decision-making? Briefly discuss.   8

    (b) What is a file? What are the features of file management?   8

    (c) How does a floppy disk work? Give a schematic detail of its working with the capacities available today.   4

8. (a) What is the structure of a typical UNIX file system? Differentiate between (i) ordinary file, (ii) directory file, and (iii) device file, in reference to UNIX OS.   10

    (b) Draw a schematic diagram of a full-adder and show the truth-table.   5

(c) What is a Cache memory? How does it improve the performance of the computer system?   5

Group C

9. Only one choice is correct. Select the most appropriate one for the following: 2 × 10

    (i) Which of the following is the base class for stream classes in C^{++}?

      (a) iostream

      (b) streambuf

      (c) ios

      (d) streambuffer

    (ii) A static automatic variable is used to

      (a) make a variable visible to several functions

      (b) make a variable visible to only one function

      (c) conserve memory when a function is not executing

      (d) initialize a pointer

    (iii) A member function can always access the data in

      (a) the object of which it is a member

      (b) the class of which it is a member

      (c) any object of the class of which it is a member

      (d) the public part of its class

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(*iv*) Which of the following is cheapest memory ?

(*a*) RAM

(*b*) Floppy

(*c*) Magnetic tape

(*d*) Cache

(*v*) In DBMS, the field, which uniquely identifies the value in the table, is known as

(*a*) foreign key

(*b*) secondary key

(*c*) primary key

(*d*) column

(*vi*) The strategic information system is used for

(*a*) taking structured decision.

(*b*) taking semi-structured decision.

(*c*) making life-cycle easier.

(*d*) taking unstructured decision.

(*vii*) A program segment defines :
  int $x = 5$; int $y = 6$; int z;
  the expression $z = (x > y)$? x : y;
  will give the value of z as

(*a*) 5

(*b*) 6

(*c*) 0

(*d*) 1

(*viii*) The input to an XOR gates are :
  $x = 0110$ and $y = 1010$. The output will be

(*a*) 0110

(*b*) 1010

(*c*) 1100

(*d*) 0011

(*ix*) In UNIX file system, the root directory is denoted by

(*a*) \

(*b*) /

(*c*) ·

(*d*) ··

(*x*) Which of the following is a universal gate ?

(*a*) AND

(*b*) OR

(*c*) XOR

(*d*) NAND

AN 203/AD 303 (1403)   (6)   (*Continued*)

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COMPUTING AND INFORMATICS

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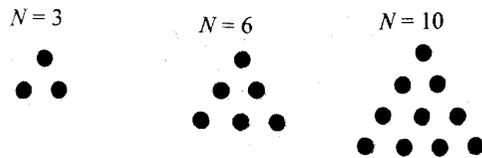*All parts of a question (a, b, etc) should be
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Group A

1. (a) Write a C^{++} program to find out the largest and smallest among 10 (ten) unsigned integers to be inputted. Clearly specify through comments each distinct processing sections.   9+9

   (b) Write a single C^{++} statement that assigns $x - y$ to z and at the same time increments x by 1 and decrements y by 1.
   $z \leftarrow$ Increment x by 2–Decrement y by 1.   2

2. (a) Write a single C^{++} function that can test whether a specified unsigned integer N happens to be a tri-angular number, i.e., if one can arrange for N number of pebbles then those pebbles can be arranged to form a symmetric triangle. For example,

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$N = 3$ $N = 6$ $N = 10$

The function should return '1' as well as print the message 'The given number is triangular' or alternately it should return '0' as well as print the message 'The given number is non-triangular' depending on the value of N.   18

(b) Write a single C^{++} assignment statement that will assign to an integer variable a the minimum of 2, other integer variables b and c.   2

3. (a) Write a C^{++} function that compares 2 two-dimensional integer arrays $A[M, N]$ and $B[M, N]$, i.e., both of identical size and assigns the values $-1, 0$ and $+1$ to each element of a third array $e[M, N]$ according to the following table:

$C[I, J] \leftarrow -1$ if $A[I, J] > B[I, J]$
$C[I, J] \leftarrow 0$ if $A[I, J] = B[I, J]$
$C[I, J] \leftarrow +1$ if $A[I, J] < B[I, J]$ 16

(b) Write an algorithm in English like steps that will replace by ϕ all those elements from a numeric one-dimensional array $A[N]$ which are greater than 99.99.   4

4. Specify the 5 (five) layer internet model that is employed in modern state-of-the art networked systems, using a schematic diagram.
Discuss in brief the functions of each of these layers.   4+16

Group B

5. (a) Convert the following integers into its equivalent form as specified. Specify all the steps in each case: 4×3

(i) 2456_{10} to its equivalent octal

(ii) 1267_8 to its equivalent binary

(iii) $AE29_{16}$ to its equivalent decimal

(iv) 110111100101_2 to its equivalent hexadecimal number.

(b) Draw logic diagrams that use only 2 input NOR gates to implement each of the following logic gates: 2×4

(i)   2 input OR

(ii)   2 input AND

(iii)   NOT

(iv)   2 input EX-OR.

6. (a) Construct a 2 bit Adder-cum-Subtractor using 2 bit Full Adder block and other logic gates. Specify all your assumptions as well as design steps.   10

(b) Specify the structure of a bidirectional 4 bit shift register built using J-K flip-flop and logic gates. Depending on user input, one should be able to shift left or right the stored data.   10

7. (a) What are the different forms of secondary storage media employed in modern day computer systems? Explain their usefulness and applications in short and precise forms.   4+4

(b) Draw the typical process state diagram of a Unix operating system with clear labelling of different states as well as state transitions. Briefly describe the diagram you have drawn.   12

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8. (*a*) Briefly explain the role of an operating system.   5

(*b*) Briefly explain the important components of Unix operating system and their roles.   10

(*c*) What is a file system? Explain briefly how files are organized in Unix.   5

Group C

9. Justify and/or contradict each of the following statements with proper reasoning in each case. No credit will be given for merely specifying yes/no or true/false: 2×10

(*i*) Pentium is a 64 bit machine since it has got 64 bit Data Bus.

(*ii*) Microsoft windows 2000 is a single user operating system.

(*iii*) C++ is a completely portable language.

(*iv*) An Assembler for Pentium is mandatory to support C++ execution in a Pentium based PC.

(*v*) TCP/IP can be run only when Ethernet is available as the data link protocol.

(*vi*) Internet refers to a network of computers connected through optical fibres and other form of wired cables.

(*vii*) C++ compiler cannot handle scanf and printf commands as available in C.

(*viii*) Modem as well as Ethernet Card are essential to provide Data One Broadband Connection.

(*ix*) L1 cache is a split memory to speed up execution.

(*x*) The primary memory of every computer is essentially magnetic memory.

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Group A

1. (*a*) Mention at least three important features of C^{++}
    programming that are different from C programming.
    Explain your answer using suitable examples.   6

    (*b*) What are the advantages of C^{++} programming
    compared to C programming ?   4

    (*c*) Write a C^{++} program to read 20 integral numbers from
    keyboard and from these separately print the follo-
    wing: (*a*) All even numbers, (*b*) All odd numbers,
    (*c*) All numbers that are perfect squares.   10

(*Turn Over*)

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2. (a) What are constructors and destructors in C^{++}? Explain their use with suitable examples. 8

(b) Define a structure containing book name, book access number, author name, rack number at which book is located. Make suitable assumptions regarding the size and type of these data. 4

(c) Define an array of book structures using the structure definition of part (b) of this question. Write a method to sort the array of book structures in ascending order of access number. 8

3. (a) Explain the difference between a LAN and a WAN. 4

(b) Explain, with the help of a schematic diagram, how LANs can be internetworked. 8

(c) Explain how reliable transmission of data is achieved using TCP/IP even when the communication channel is noisy. 8

4. (a) With the help of an example, explain how an information system can be used for decision making. 7

(b) In an information system, what problems might occur if the data are stored in files rather than a database management system (DBMS)? 6

(c) Develop the flow-chart representation for a program that would read an integer from the user representing the number of terms in a Fibonacci series and then print the terms in the series. 7

Group B

5. (a) Give an algorithm to convert an octal number into a binary number. Using an example, explain how the algorithm works. 8

(b) Draw a schematic diagram to show the different functional blocks inside a CPU and also show how they are interconnected. Briefly explain the roles of different functional blocks. 6

(c) Explain different types of secondary storage used in computers. 6

6. (a) What is the difference between a system software and an application software? Give at least two examples of each. 6

(b) What is the difference between a compiler and a translator? Explain the relative advantages of these two techniques. 6

(c) What is the difference between multiprogrammed, multitasking and time-shared operating system? What is the advantage of a time-shared operating system over a multiprogrammed and a multitasking operating system? 8

7. (a) What do you understand by a file system? How are files organized in the file system of Unix? 7

(b) Using a schematic block diagram, explain how CPU, memory, secondary storage, and the input/output units are interconnected in a computer. Explain how they interact with each other. 7

(c) Briefly explain the main functions of an operating system. 6

8. (a) Draw the truth table for the Boolean function $\bar{A}BC + A\bar{B}C + AB$. 5

(b) Realize the Boolean expression of Q. 8 (a) by using logic gates. 5

(c) What do you mean by a virtual memory operating system? What are its advantages over an operating system using physical memory only? 5

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(*d*) What is Cache memory ? How does Cache memory improve the performance of a computer ?   5

Group C

9. Identify whether the following statements are *true* or *false*. Also, justify your choice in one sentence. All programming related questions refer to C^{++} : 2×10

(*i*) A variable of type char can be used to store the integer 101.

(*ii*) A variable defined within a function is visible to all functions onwards from its point of definition.

(*iii*) The element referred to by array Example [5] is the sixth element of the array.

(*iv*) The binary representation of the decimal number 45·25 is 101101·1101.

(*v*) The hard disk is also known as the main memory of a computer system.

(*vi*) A minimum of four computers are required to establish a LAN.

(*vii*) The secondary memory of a computer is also known as volatile memory.

(*viii*) A management information system is an example of a system program.

(*ix*) Application programs are easier to write compared to system programs.

(*x*) MS–DOS is an example of a virtual memory operating system.

AMIE : 2 FN : AN203/AD303 (1403) (4)   AG—16,000

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W'08 : 2 FN : AN 203/AD 303 (1403)

COMPUTING AND INFORMATICS

Time : Three hours

Maximum Marks : 100

Answer FIVE *questions, taking* ANY TWO *from* **Group A,**
ANY TWO *from* **Group B** *and* ALL *from* **Group C.**

*All parts of a question (a, b, etc.) should be
answered at one place.*

*Answer should be brief and to-the-point and be supple-
mented with neat sketches. Unnecessary long answer
may result in loss of marks.*

*Any missing or wrong data may be assumed suitably
giving proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. (*a*) Describe the use of following key words in
   C/C^{++} :   3 × 2

   (*i*) Short

   (*ii*) Auto

   (*iii*) Static

   (*b*) The following program was written to interchange
   the values assigned to two integer numbers:

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```
# include < stdio.h >
void swap (int x, int y)
{
    int p, q ;
    p = x ;
    q = y ;
    x = q ;
    y = p ;
}
void main ( )
{
    int a = 5 ;
    int b = 3 ;
    swap (a, b) ;
    printf (("%d   %d\n", a, b) ;
}
```

What will be the output of the program? Explain why the above program will not give the desired output.   6

(c) How will you modify the program so that the values are interchanged in the function swap( ) and are displayed in function main( )?   8

2. (a) Integer variable w and float variables, x and y, have been initialized as under:

$$w = 356, \quad x = -23\cdot4553, \quad y = 2\cdot34 \times 10^{-2}$$

Write C printf statements to display

(i) variable w with filed width of 5 columns;

(ii) variable x in decimal mode with filed width of 12 columns, with 5 places following the decimal point; and

(iii) variable z in scientific mode with filed width of 12 columns.   3

(b) Describe the structure of a switch statement in C. What is meant by a default block in a switch statement?   5

(c) Write a function to receive, as arguments, the number of elements in an array of integer numbers and the pointer to the array. Evaluate average of the numbers in the array and return the same to calling function.   6

(d) Write a program to read 10 integer numbers and find their average. Use the function defined above.   6

3. (a) Describe the use of following key words in C/C++ programming: 3+3

(i) Break

(ii) Continue.

(b) What is a binary file? How does it differ from a text file? How will you open a binary file for reading using C command and read all records starting from the beginning till the end of the file and display each record on the monitor?   8

(c) Describe the role of the following functions as useful debugging aids: 3+3

(i) ferror( )

(ii) perror( ).

4. It is required to define a class with the following data members about books available in a library:

(i) Accession number (six digit integer number)

(ii) Title (character string, maximum 40 characters)

(iii) Name of author (character string, maximum 30 characters)

(iv) Price (floating point number)

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Define the class with the following methods :

A class constructor

A method to append records to the file in which the information is stored

A method to locate a book given its accession number and display its title, author and price.   20

Group B

5. (a) List the technological developments that have contributed to the following features of modern computers :

3×4

(i) Small size

(ii) High reliability

(iii) Fast speed.

(b) Prove that the following Boolean expression reduces to 0 :

$$R = (A + B) \cdot (A'B').$$ 4

(c) Draw a logic circuit for the following Boolean expression :

$$P = AB + BC + AC$$ 4

6. (a) Describe the working principle of a laser printer.   8

(b) How does the word length of a computer determine the architecture of its RAM ? Also, explain the role of RAM in the working of a computer.   8

(c) Distinguish between machine language and assembly language.   4

7. (a) What is a database ? How does it differ from a set of independent files ? How does a database facilitate data security and integrity ?   8

(b) List the salient features of a technical report prepared for the top management.   6

(c) Describe the importance of graphics in a report and discuss the following graphic tools given in MS Excel :

3+3

(i) Pie Chart

(ii) Bar Chart.

8. (a) Explain why computers without operating systems have only limited applications.   8

(b) Distinguish between the following DOS commands :

3+3

DIR and DIR/S
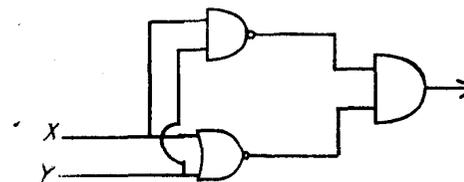
COPY SALES * DATA:\ and COPY SALES ? DATA:\

(c) Windows XP has an application known as Notepad for editing text files. How will you open notepad starting from the start button ? How will you create an icon for notepad on the desktop so that the application runs when you click on its icon.   3+3

Group C

9. Answer the following : 2×10

(i) What is the octal equivalent of the decimal number 1000 ?

(ii) What will be the output of the following logic circuit when X and Y are both 1 "

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(*iii*) Name the input device that can help a computer to read printed documents.

(*iv*) If more than one printer has been attached to a computer, how can you direct your output to a specific printer ?

(*v*) What is the range of numbers that can be assigned to a variable declared as an unsigned integer ?

(*vi*) What will be the output generated by the following code ?

```
int k = 5 ;
int i = 0 ;
if (k) i++ ;
cout << i
```

(*vii*) What output will the following code generate ?

```
char c = 'A' ;
int I ;
for (i = 0 ; i < 3 ; i++)
    cout << c++ ;
```

(*viii*) What will be the implication if data members of a class are declared as public members ?

(*ix*) What will be the output of the following code ?

```
int x [] = {3, 5, 8} ;
cout << *x ;
cout << * (x + 1) ;
```

(*x*) Why is the following code illegal ?

```
int x[] = {2, 4, 6} ;
cout << *x ;
cout << *px++ ;
```

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S'09 : 2 FN : AN 203/AD 303 (1403)

COMPUTING AND INFORMATICS

Time : Three hours

Maximum Marks : 100

Answer FIVE *questions, taking* ANY TWO *from* **Group A,**
ANY TWO *from* **Group B** *and* ALL *from* **Group C.**

*All parts of a question (a, b, etc.) should be
answered at one place.*

*Answer should be brief and to-the-point and be supple-
mented with neat sketches. Unnecessary long answer
may result in loss of marks.*

*Any missing or wrong data may be assumed suitably
giving proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. Assume that a cartesian co-ordinate point is represented
   by a pair of integers (X, Y) indicating its X and Y co-ordi-
   nate values.

   (a) Define a class, named, Coord that would store X and
        Y co-ordinate values.   4

   (b) Overload the constructor of the Coord such that if
        no parameters exist, then the co-ordinate with default
        parameter (0,0) is created, otherwise a co-ordinate
        point with specified X and Y values should be crea-
        ted.   6

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(*c*) Read 10 pairs of integers and create the corresponding ten co-ordinate points.   5

(*d*) Arrange the created co-ordinates of part (*c*) of this question in the increasing order of X co-ordinates.   5

2. (*a*) What is the difference between call by reference and call by value mechanisms ? Illustrate the use of these two by using appropriate C^{++} code segments. Which is the mechanism used to pass object parameters ?   10

(*b*) What do you understand by method overloading? Explain its use by using an example. How is method overloading different from method overriding?   10

3. A class has 30 students. Each student has a name (up to 30 characters) and roll number (integer). Each student appears in an examination of 100 marks. The names of the students who have scored more than class average need to be printed.

(*a*) Draw flow-chart for the problem.   6

(*b*) Write C^{++} code for solving the problem. The code should be adequately documented.   14

4. (*a*) What are the advantages of storing data pertaining to an application in a database management system compared to storing data in a file.   7

(*b*) What is a relational database management system?   6

(*c*) Why data in an RDBMS needs to be normalized ?   7

Group B

5. (*a*) Using a block diagram, show how the CPU, the cache, the memory unit, and the secondary storage units of a computer are interconnected.   8

(*b*) What do you understand by cache memory ? Why is cache memory needed in a computer ?   6

(*c*) Write the truth table of a 1-bit adder and draw the logic gate design of the 1-bit adder.   6

6. (*a*) What is the role of an operating system in a computer ?   6

(*b*) What do you understand by booting of a computer ? What are the main activities that are carried out by a computer during booting ?   7

(*c*) What is a flip-flop ? Draw the logic gate representation of a flip-flop. How is a flip-flop useful ?   7

7. (*a*) What do you understand by file management ? Explain the organization of a file system using a suitable schematic diagram.   8

(*b*) Convert the following two hexadecimal numbers into binary and decimal numbers : (*i*) 9F, and (*ii*) E7.   6

(*c*) Perform the following hexadecimal operations : (*i*) 5F + AB, and (*ii*) CD + BE.   6

8. (*a*) Explain how data are stored and accessed from a hard disk.   7

(*b*) What is BIOS in DOS ? What is its role ?   7

(*c*) What are the important ways in which Windows operating system is different from DOS ?   6

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Group C

9. Choose the *correct* answer for the following and write *one* sentence justification for your choice: 10×2

(*i*) The packing of data and functions into a single unit in a program is known as

(*a*) polymorphism

(*b*) abstraction

(*c*) encapsulation

(*d*) inheritance

(*ii*) The mechanism of defining the same method with multiple types of parameters is known as

(*a*) method overriding

(*b*) method overloading

(*c*) virtual method

(*d*) method aggregation

(*iii*) The type of members of a class are by default

(*a*) private

(*b*) public

(*c*) protected

(*d*) None of the above.

(*iv*) For the following C program, how many times is the for loop executed?

```
main(){
    int i;
    for (i = 0; i < 10;)
        printf("loop count = %d\n", i);
}
```

(*a*) 9

(*b*) 10

(*c*) 11

(*d*) infinite number of times

(*v*) In the following C program segment, what would be the value of x after the execution of the program segment?

```
x = -5; y = 10;
if (x > y)
    if (x < 0) x = x*-1;
    else x = 2*x;
```

(*a*) 5

(*b*) -5

(*c*) 10

(*d*) -10

(*vi*) What are the typical capacities of (*i*) main memory, and (*ii*) hard disk of a modern PC?

(*a*) 1 Gb and 150 Gb

(*b*) 1 MB and 20 Mb

(*c*) 15 Kb and 200 Mb

(*d*) 20 Gb and 800 Gb

(*vii*) What would be the output of the following program:

```
main (){
    printf ("Expression values = %d %d\n",
            5/2*2, 6/2*2);
}
```

(a) 1,1

(b) 6,6

(c) 5,6

(d) 4,6

(viii) Consider the following C program. How many times will the print statement be executed ?

```
for( i=0; i<99; i++)
    for( j= i; j<100; j++)
        printf ("Institution of Engineers\n") ;
```

(a) 9900

(b) 4950

(c) 5049

(d) 5051

(ix) What is the binary representation of 0·125 ?

(a) 0·11

(b) 0·01

(c) 0·001

(d) 0·011

(x) The *scope* of a variable refers to the

(a) range of values that the variable may assume.

(b) portion of code in which the variable may be meaningful.

(c) set of variables to which the given variable can be meaningfully assigned.

(d) set of variables from which the given variable can meaningfully assume.

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W'09 : 2 FN : AN 203/AD 303 (1403)

COMPUTING AND INFORMATICS

Time : Three hours

Maximum marks : 100

Answer FIVE *questions, taking* ANY TWO *from* **Group A,**
ANY TWO *from* **Group B** *and* ALL *from* **Group C.**

*All parts of a question (a, b, etc.) should be
answered at one place.*

*Answer should be brief and to-the-point and be supple-
mented with neat sketches. Unnecessary long answers
may result in loss of marks.*

*Any missing or wrong data may be assumed suitably
giving proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) (i) Convert the binary real number 1101.1010 to
a equivalent decimal number.   2

    (ii) Convert the decimal fraction 0.62 to its equiva-
    lent hexadecimal fraction.   2

    (iii) Convert the octal number 364 to its equivalent
    decimal number.   2

    (iv) Convert the octal number 536 to its equivalent
    hexadecimal number.   2

    (b) What is ternary operator? Is any such operator
    available in C language? If yes, explain with an
    example?   4

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(c) Draw a flow-chart of the given problem. Read marks of four subjects and print grade of the student according to total marks obtained.   8

Total Marks	Grade
Above 800	A
601-800	B
401-600	C
201-400	D
Below 200	F

2. (a) (i) What is meant by compiling a program?   3

(ii) Differentiate between a compiler and a interpreter?   3

(b) (i) Simplify the following Boolean expression:
$$X + XY' + Y' + (X + Y')X'Y.$$ 3

(ii) Why are NAND and NOR gates called universal gates?   3

(c) What is EPROM? How is it different from PROM?   4

(d) (i) Perform the following addition: 2

$$1010111 + 1011010$$

(ii) Perform the following subtraction: 2

$$1101011 - 1010110$$

3. (a) (i) What is memory management? Why is it essential in a multi-user environment?   4

(ii) How does a 'while' control structure differ from 'do-while' structure?   3

(b) With a suitable block diagram, briefly explain the major components and their functions of any conventional computer system.   7

(c) (i) What is a protocol? What is IP protocol?   3

(ii) What is Telnet?   3

4. (a) (i) What is the difference between application software and system software?   4

(ii) What is device driver and explain its function?   4

(b) (i) Distinguish between the data and information.   3

(ii) What is a key word and what are the restrictions of using them?   3

(c) Explain the following: (i) Bridge, and (ii) router.   3+3

Group B

5. (a) (i) List the desirable features of an algorithm.   3

(ii) What is a program counter? What information does it store?   3

(b) Write a program to add first seven terms in the following series: 6
$$1/1! + 2/2! + 3/3! + 4/4! + ...$$

(c) Write a program to print four digit positive integer number in reverse order.   6

(d) What is bitwise operator?   2

6. (a) Write a program to display all the prime numbers from 70 to 100.   6

(b) Write a program to evaluate the factorial value of a number.   6

(c) Write a program to find the length of given string.   6

W'09 : 2FN : AN 203/AD 303 (1403) (3)   (Turn Over)

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(*d*) What is void pointer ?   2

7. (*a*) Distinguish between the block variable and the local variable.   3

(*b*) What is the task performed by the fseek ( ) function ?   3

(*c*) What is the difference between process and processor ?   2

(*d*) Write a program to read names of students in a file and copy the data from that file to another file.   6

(*e*) Write a program to reverse a string and check for palindrome.   6

8. (*a*) Write a program to display the ASCII value of a given character.   6

(*b*) Distinguish between break and continue statements in C.   4

(*c*) Write a program to check whether the given number is an Armstrong number.   6

(*d*) How is XCOPY a better command than COPY ?   4

Group C

9. Choose the *correct* answer from the following and write one sentence justification for your choice : 10×2

(*i*) main ( )
```
{
int x = 4, y, z ;
y = - - x ;
z = x - - ;
 printf ( "\n%d %d %d", x,y,z) ;
}
```
output

(*a*) 2 2 2

(*b*) 2 3 3

(*c*) 5 4 2

(*d*) 1 1 1

(*ii*) main ( )
```
{
int x = 1 ;
while (x = = 1 )
{
x = x - 1 ;
printf ( "%d\n", x) ;
}
}
```
output

(*a*) 0

(*b*) 2

(*c*) 3

(*d*) 1

(*iii*) main ( )
```
{
int a[ 10] ;
for (i = 1 ; i < = 10 ; i++)
{
scanf ( "%d", a[i]) ;
printf ( "%d", a[i]) ;
}
}
```
output

(*a*) 10 20 30 40

(*b*) 10 30 40 20

(*c*) 20 10 30 40

(*d*) 10 20 30 50

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S'10 : 2 FN : AN 203/AD 303 (1403)

COMPUTING AND INFORMATICS

Time : Three hours

Maximum Marks : 100

Answer FIVE *questions, taking* ANY TWO *from* **Group A,**
ANY TWO *from* **Group B** and ALL *from* **Group C.**

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answered at one place.*

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mented with neat sketches. Unnecessary long answers
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Figures on the right-hand side margin indicate full marks.

Group A

1. (*a*) Write a C program to define a global integer array
named Arr of size 100. Write a function named
sum-iter to iteratively sum all the elements of Arr
and return the result.   5

   (*b*) Write a recursive routine name sum-rec to sum all
the elements of Arr and return the result.   5

   (*c*) Between the iterative routine sum-iter and
recursive routine sum-rec, which is more efficient
and why ?   5

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(d) What do you understand by 'scope' of a variable ? Explain the scoping rule when a global variable and a local variable in a function have the same name.   5

2. (a) Write the flow-chart representation of an algorithm named binary-search, that takes a sorted array, size of the array, and an element to search as argument and performs a binary search for the element in the array. If the element is found in the array, it should return the position at which it occurs, otherwise it should return − 1.   7

(b) Write a C function to implement the binary search algorithm of part (a).   7

(c) What are the worst case, best case and average case number of comparisons to search an element using binary-search algorithm.   6

3. (a) In C^{++}, define a class point to store to floating point numbers x and y that would represent the x and y co-ordinates of a point in a cartesian co-ordinate system. Define method 'create' to initialize the x and y attributes with given values, and 'print' to print the x and y attribute values.   5

(b) Overload 'create' method to initialize x and y attributes with default value 0.   5

(c) Overload the '+' operator to perform addition operation of two points.   5

(d) Derive a 'line' class from 'point' class. Remember that a line is defined by its two end points.   5

4. (a) What is a LAN ? Explain a LAN protocol.   6

(b) What are the functions of TCP and IP ?   6

(c) How does TCP ensure reliable transfer of packets ?   8

Group B

5. (a) An operating system is often defined as a resource manager. Explain which resources of a computer it manages and how it manages.   7

(b) What is a time-shared operating system ? Draw a labelled task state transition diagram for a time-shared operating system, and briefly explain it.   7

(c) Explain the important aspects in which the Windows operating system enhances the MS-DOS operating system.   6

6. (a) Write the truth table for the Boolean function $Z = \overline{(a + b) \cdot c}$.   5

(b) Draw the logic circuit for the Boolean function of part (a) above.   5

(c) Distinguish between a combinational logic circuit and a sequential circuit.   5

(d) Draw the logic circuit of a J-K flip-flop.   5

7. (a) Convert the following binary numbers into hexa-decimal numbers :   3 + 3

$$101101 \cdot 0101$$
$$1010 \cdot 0111$$

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(b) What is an 'interrupt' in a computer system ? How is an interrupt handled ?   6

(c) What are linkers and loaders ? What functions do they perform ?   8

8. (a) Briefly explain the UNIX file system.   7

(b) Using a block diagram, explain how multiple input/output devices can be connected to the computer bus. How can the CPU address a desired device using your scheme ?   6

(c) What is the difference between a compiler and an interpreter ? Explain an application in which an interpreter would be useful.   7

Group C

9. Write brief answers for the following :   10 × 2

(i) Evaluate the following C expression, and explain your answer :

$$5 + 2/3 \star 5 - 4/3$$

(ii) Name two application layer protocols.

(iii) What are the typical sizes of the main memory and hard disk of a modern desktop computer ?

(iv) Is a two-dimensional array passed as a value or reference argument to a function ? Explain your answer by writing a function prototype illustrating this.

(v) Define a C structure named str that has an interger i, an integer array of size 10 called arr, and a character c as its members.

(vi) The size of the address bus and data bus of a CPU is 16 bits and 32 bits, respectively. What can be said about the size of its internal registers and address space ?

(vii) What is the full form of SMTP ? For what application is it used ?

(viii) Mention two advantages of a DBMS over a file storage of data.

(ix) What is a foreign key in an RDBMS ?

(x) What is the binary representation of 0.125 (decimal) ?

W'10 : 2 FN : AN 203/AD 303 (1403)

COMPUTING AND INFORMATICS

Time : Three hours

Maximum Marks : 100

Answer FIVE *questions, taking* ANY TWO *from* **Group A,** ANY TWO *from* **Group B** *and* ALL *from* **Group C.**

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Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answers may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) How are functions defined in C and what are the different ways in which arguments are passed to a function?   5

    (b) Write a non-recursive function to calculate the factorial of a given integer n.   5

    (c) Write a recursive function to calculate the factorial of a given integer n.   5

    (d) Write a C program to find the sum of the series up to n terms. Assume x is a floating point number.

$$1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \ldots + \frac{x^n}{n!}$$ 5

2. (a) Write an algorithm to triangularization of n linear equations in n unknowns.   6

(Turn Over)

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(*b*) What is ARP ? How it differ from IP ? At what layer of OSI model does it work ?   7

(*c*) Construct an Entity-Relationship diagram for a car insurance company whose each customer more or less has its own car. Each car has associated with it zero to any number of recorded accidents.   7

3. (*a*) List *four* significant differences between a file processing system and a DBMS.   6

(*b*) Explain the difference between the logical and physical data independence.   6

(*c*) Write a C program to determine how much money will accumulate in a bank after *n* years, if a known amount, *P*, is deposited initially and the amount collects interest at a rate of *r* percent per year compounded annually.   8

4. (*a*) Write a C^{++} program to print the universal time and standard time using a time class.   7

(*b*) Write a C^{++} program to overload the stream insertion operator (<<) to handle data of a user defined-type, which is a phone number of the form : area code-exchange and number.   7

(*c*) List *six* major steps that one can take in setting up a database for a particular enterprise.   6

Group B

5. (*a*) Write *four* major responsibilities of an operating system. Give essential properties of MS-DOS.   7

(*b*) What is the difference between a compiler and an interpreter ? Compare the relative advantages of a compiled language and an interpreted language.   6

(*c*) What is a file system and an *i*-node ? How does the operating system protect files of one user from other users ?   7

6. (*a*) Realize the digital circuit for the Boolean function
$$z = b.c + a.b + a.c$$
by using AND and OR gates.   6

(*b*) Convert the following binary numbers to their equivalent hexadecimal numbers :   3+3

(*i*) $(111100110.101011)_2$

(*ii*) $(111010100011.01010110)_2$

(*c*) Find the values of the following binary arithmetic operations :   4+4

(*i*) Divide $(100101100)_2$ by $(1010)_2$

(*ii*) Multiply $(11101)_2$ by $(11011)_2$.

7. (*a*) Find the values of two valued variables *A, B, C,* and *D* by solving the set of simultaneous equations :
$$A' + AB = 0$$
$$AB = AC$$
$$AB + AC' + CD = C'D$$
where x' represents the complement of *x*.   7

(*b*) Given a regular expression
$$a^* (a/b) aa$$
construct an equivalent non-deterministic finite automata (NFA).   7

(*c*) Simplify the following algebraic equations :   3+3

(*i*) $(x' + xyz') + (x' + xyz') (x + x'y'z)$

(*ii*) $xy + wxyz' + x'y$.

8. (*a*) What are the components of a computer ? Draw the Von-Neumann architecture of a computer, and explain its working.   7

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(*b*) Draw the block diagram of a SR flip-flop and imple-
ment it by using crossed coupled NOR or NAND
gates.　　　　　　　　　　　　　　　　　　7

(*c*) How many bits are required to represent the following
decimal numbers as unsigned/binary integers:
(*i*) 384, (*ii*) 147.　　　　　　　　　　3+3

Group C

9.　Answer the following:　　　　　　　　　　10×2

(*i*)　　How many RAM chips of size 256 KB are required
to realize a 1 GB memory?

(*ii*)　　List the basic difference between **DOS and Unix**.

(*iii*)　　List two disadvantages of a database system as
compared to a file-based system.

(*iv*)　　What information does a superblock of a file
system contain?

(*v*)　　Give the hexadecimal equivalent of the following
binary number: $(101101.0101)_2$

(*vi*)　　Show that $a + (a \cdot b) = a$.

(*vii*)　Explain the following statement of C:
　　　　　int (* *x*) [20];

(*viii*) What does MIME stands for and where is it
used?

(*ix*)　　Two PCs are located in adjacent rooms and a
third PC is in a building 300 yards away. Explain
how you could connect three PCs to create a
single network.

(*x*)　　What is the output of the following C^{++}
statement?
cout <<fixed <<left <<set precision
(1) <<setw(15)<<333.546372

S'11 : 2 FN : AN 203/AD 303 (1403)

COMPUTING AND INFORMATICS

Time : Three hours

Maximum marks : 100

Answer FIVE *questions, taking* ANY TWO *from* **Group A,** ANY TWO *from* **Group B** *and* ALL *from* **Group C.**

All parts of a question (a, b, etc.) should be .
answered at one place.

Answer should be brief and to-the-point and be supple-mented with neat sketches. Unnecessary long answers may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) What is an algorithm and a flow-chart ? Taking a simple problem as an example, give an algorithm for that problem and also its corresponding flow-chart.   7

   (b) Illustrate call-by-value and call-by-reference with suitable examples.   7

   (c) Write a C^{++} program to read 100 numbers from the user and output their sum.   6

2. (a) What is function overloading in C^{++} ? Explain with a suitable example.   6

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(*b*) What is a constructor? Explain its use using an example.   6

(*c*) What is a recursive function? Write a recursive function, factorial ( ), for computation of factorial of an integer. Also, show execution of fact (3).   8

3. (*a*) Write a program to sort an array of 100 integral numbers.   10

(*b*) Discuss the functionalities of different TCP/IP layers.   10

4. (*a*) What do you mean by office automation? Explain the primary activities relating to office automation.   8

(*b*) Explain the stages of compilation for a C compiler.   8

(*c*) What is an interpreter?   4

Group B

5. (*a*) Show that
$$A + \bar{A}B = A + B$$ 6

(*b*) What is an operating system? Discuss about different types of operating systems.   6

(*c*) Explain the working of NAND latch with a diagram.   8

6. (*a*) Explain the purpose of following DOS commands: 6 × 2

    C: DIR   MD   CD   COPY   Del

(*b*) Explain the concepts of pipelines and filters in UNIX operating system with suitable examples.   4+4

7. (*a*) Explain the difference between primary and secondary computer memory.   4

(*b*) Discuss briefly the role of secondary storage.   4

(*c*) How does the CPU execute program instructions? Explain using a block diagram.   12

8. (*a*) Compare a system software and an application software. Give examples of each.   6

(*b*) Draw truth table for the Boolean function
$$f(A, B, C) = A \oplus B \oplus C$$ 6

(*c*) Explain the organization and working of a hard disk.   8

Group C

9. Answer the following: 10 × 2

(*i*) What is the purpose of exit () command?

(*ii*) What is a global variable? How long does a global variable remain alive?

(*iii*) What do you mean by a pointer variable in C programming? Give an example.

(*iv*) Explain how one can recall a previously used DOS command by pressing some key.

(*v*) What happens when the following command is used?
chmod u = rwx,go=r-x foo

(*vi*) Transform $(37.24)_8$ into its equivalent binary form.

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W'11:2 FN:AN 203/AD 303 (1403)

COMPUTING AND INFORMATICS

Time : Three hours

Maximum Marks : 100

Answer FIVE *questions, taking* ANY TWO *from* **Group A,**
ANY TWO *from* **Group B** and ALL *from* **Group C.**

*All parts of a question (a, b, etc.) should be
answered at one place.*

*Answer should be brief and to-the-point and be supple-
mented with neat sketches. Unnecessary long answer may
result in loss of marks.*

*Any missing or wrong data may be assumed suitably
giving proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. (*a*) What do you understand by structured programming ?   5

    (*b*) What is a function prototype ? Why is it required ?   5

    (*c*) Using an example, show how a single dimensional
    array is passed to a function (your example should
    have both the function definition and the call
    statement).   5

    (*d*) Using an example, show how two-dimensional array
    is passed to a function (your example should have
    both the function definition and the call statement).   5

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2. (*a*) Between recursion and iteration, which is more efficient ? Why ? 5

(*b*) Write a recursive function that would take as its parameters a single dimensional integer array and an integer value indicating the number of elements present in the array and would return the sum of numbers in the array. 10

(*c*) Declare a structure named student having name (10 characters), roll (integer), mark (float). 5

3. (*a*) What will be printed out by the following C program ? Explain the reason behind your answer. 10

```
#include < stdio.h >

int a [J = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

main ( ) {

    int i ;

    for (i = 0;  i < 10;  i++){

        *(a + i)+ = 1;

        Printf("%d \n", *(a + i));

    }
```

(*b*) Briefly explain how TCP/IP achieves error-free transmission of data ? 10

4. (*a*) Explain the working of a e-mail system, and the specific protocols that it uses. 10

(*b*) What do you understand by a client-server system ? Give an example of a client-server system. What are the advantages of a client server system as compared to a monolithic system ? 10

Group B

5. (*a*) Convert 211.25 in decimal to binary. 5

(*b*) Convert 211.25 in decimal to octal. 5

(*c*) Draw the truth table for the Boolean expression
$$\bar{a}b + \bar{b}c + a\bar{c}.$$ 5

(*d*) What is a cache memory ? What is its role in computer operation ? 5

6. (*a*) Using an appropriate block diagram, explain how CPU, main memory, cache memory, secondary memory, and the input/output units are interconnected in a computer. 10

(*b*) Draw the truth table of a 2 to 4 decoder, and realize the decoder circuit using AND and NOT gates. 10

7. (*a*) Explain the principal differences between a system software and an application software. 5

(*b*) What is a virtual memory operating system ? 5

(*c*) Explain, using a suitable diagram, how the virtual address is mapped to a physical address. 10

8. (*a*) What is meant by a process in an operating system ? 5

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(b) What is meant by a time-shared operating system ?   5

(c) What is meant by a system call ? Give an example of a system call. How is a system call different from a function call ?   10

Group C

9. Answer the following :   10 × 2

(i)   How much time will be required to transmit 100 K bits of data over a 100 Mbps line ?

(ii)   What does 'scope' of a variable mean ?

(iii) What will be the output of the following C program ?

```
main ( ){

    int i = 0;

    for (; ; ;) Printf ("%d\n", i++) ;
```

(iv)   What will be printed by the following program segment ?

```
int a;

a = 2 + 5 / 20*30 - 1;

Printf ("value of a = %d \n",a) ;
```

(v)   Which of the following best describes the Internet ?

(a) LAN

(b) MAN

(c) WAN

(d) Ethernet

(vi) Consider the following function in C :

```
void swap (int a, int b) {
    int temp ;
    temp = a ;
    a = b ;
    b = temp ;
}
```

Correct the function (if necessary) so that a call to the function, e.g., swap (&x, &y) would interchange the values of x and y.

(vii) Which one of the following statements is false ?

(a) Compilers can detect runtime errors.

(b) Some Unix versions can run on laptops.

(c) Mouse is connected to the computer through the serial interface.

(d) Executable files contain machine code.

(viii) Which one of the following can be considered as an output device of a computer ?

(a) VDU

(b) Mouse

(c) Keyboard

(d) Modem

(ix) Which one of the following statements is false ?

(a) Main memory can be accessed faster than secondary memory.

(b) Main memory is a permanent storage memory.

(c) Cache memory is a volatile memory.

(d) Hard disk is a secondary memory.

(x) What is the full form of HTML ?

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S'12 : 3 FN : AN 203/AD 303 (1403)

COMPUTING AND INFORMATICS

Time : Three hours

Maximum Marks : 100

Answer FIVE *questions, taking* ANY TWO *from* **Group A,**
ANY TWO *from* **Group B** *and* ALL *from* **Group C.**

*All parts of a question (a,b,etc.) should
be answered at one place.*

*Answer should be brief and to-the-point and be supplemented
with neat sketches. Unnecessary long answers may
result in loss of marks.*

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proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. (*a*) Design an algorithm to convert a character of 32-bit 2s complement number into its decimal equivalent.   7

   (*b*) Represent your algorithm arrived at **Q.1** (*a*) in flow-chart form.   5

   (*c*) Write a C function that accepts a character string of 32 characters representing a 2s complement number and returns its decimal equivalent.   8

2. (*a*) What is the difference between a local and a global variable ?   6

   (*b*) What is a static variable ?   6

(*Turn Over*)

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(c) Write a C function that would return an integer value, indicating the total number of times it is called. The first time it is called, it would return one, second time two, and so on.   8

3. (a) What do you understand by a macro in C ?   4

   (b) What is the advantage of writing a processing step as a macro as compared to a function ?   8

   (c) Write a macro definition for determining the larger of two integers.   8

4. (a) Briefly explain the working of the CSMA/CD protocol. At which ISO/OSI layer does it operate ?   7

   (b) Briefly explain the client-server technology. How is a client-server application developed ?   7

   (c) What is the difference between a hub and a switch ?   6

Group B

5. (a) What is a process in the Unix operating system ? How is a process created ?   6

   (b) What is virtual memory ? How does an operating system translate a virtual address into a physical address ?   8

   (c) What is the difference between a volatile and a non-volatile memory ? Explain the advantage and disadvantage of each memory.   6

6. (a) What is the role of the control unit in a CPU ? Explain the difference between microprogrammed and hardwired control. Identify their relative advantages.   10

   (b) What is an interrupt ? Who generates interrupts ? How are interrupts handled by an operating system ?   10

7. (a) Briefly explain, by using suitable diagrams, how various basic logic gates can be realized using NOT gate.   7

   (b) What is a D flip-flop ? By using an appropriate diagram, briefly explain how a shift register can be realized using D flip-flops ?   7

   (c) Convert the following sum of product (SOP) expression into product of sum (POS) expression : $\overline{A}\,\overline{B} + \overline{C}\,\overline{D}$.   6

8. (a) Convert the following octal number into its binary equivalent : 735.   6

   (b) Convert the following hexadecimal number into its octal equivalent : AFB8.   6

   (c) How is a floating point number represented in a computer ?   8

Group C

9. Answer the following in brief : 10×2

   (i) To realize 8 Mbyte of memory, how many chips of size 512 kbytes are required ?

   (ii) When an instruction is under execution, it should be in which register in the CPU ?

   (iii) What would be the binary representation of the decimal value 0·25.

   (iv) What is the full form of TCP ?

   (v) What is the name of the parameter passing mechanism that is used to pass an array as a parameter during a function call ?

   (vi) Why is it necessary to normalize the database tables ?

(*vii*) What would be displayed when the following program
is compiled and run ?

```
Main() {
        float a = 0·7;
        if (a = = 0·7) printf("Equal\n");
        else printf("Not Equal\n");
}
```

(*viii*) Which protocol is involved when a mail client sends
an e-mail to its mail server ?

(*ix*)   Why is redundancy a threat in a DBMS ?

(*x*)   What is the full form of CSMA/CD ?

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W'12:3FN : AN203/AD303 (1403)

COMPUTING AND INFORMATICS

Time : Three hours.

Maximum Marks : 100

Answer FIVE *questions, taking* ANY TWO *from* **Group A,**
ANY TWO *from* **Group B** *and* ALL *from* **Group C.**

*All parts of a question (a, b, etc.) should
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*Answer should be brief and to-the-point and be supplemented
with neat sketches. Unnecessary long answers may
result in loss of marks.*

*Any missing or wrong data may be assumed suitably giving
proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) What do you mean by typeconversion and typecasting ? Explain with an example. Write a program in C to find the largest of three numbers using ternary operator. Write a program in C to sum the series $1/1^2 + 1/2^2 + ... 1/3^2$.   3 + 3 + 4

    (b) Differentiate between formal parameters and actual parameters. Write a program to print the Fibonacci series using recursion.   5

    (c) Write a program in C++ to read marks of 10 students in the range of 0-100. Then make 10 groups : 0-10, 10-20, 20-30, etc. Count the number of values that falls in each group and display the result.   5

(Turn Over)

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2. (a) What are generic pointers ? Explain with an example.　4

   (b) Using pointers, write a program in C to read and print a text. Also, count the number of characters, words, and lines in the text.　16

3. (a) Write a program in C using an array of pointers to a structure to read and display the data of a student (like Roll No, Name, Course Fee).　8

   (b) What is an algorithm ? Explain the key features of an algorithm. Explain the differences between time complexity and space complexity.　1 + 3 + 3

   (c) Describe briefly various categories of algorithms. Write an algorithm to find the largest of three numbers.　3 + 2

4. (a) Write a C++ program to demonstrate how to call base class constructor in derived class.　8

   (b) What do you mean by a virtual function ? Explain its importance.　6

   (c) Write a C++ program to demonstrate the concept of virtual function.　6

Group B

5. (a) (i) Find the hexadecimal equivalent of $(0.3)_{10}$.　4

   (ii) Find the octal equivalent of the decimal fraction 0.789.　4

   (b) Simplify the following Boolean function in both sum-of-products and product-of-sums forms :　3 + 3
   $$F (A, B, C, D) = \Sigma\ (0, 1, 2, 5, 8, 9, 10\ )$$

   (c) Write a truth table for full adder. Also, draw a logic diagram.　3 + 3

6. (a) Give differences between (i) RISC vs. CISC, and (ii) static RAM vs. dynamic RAM.　4 + 4

   (b) Write a zero-address instruction for the following :　6
   $$X = (A + B)*(C + D)$$

   (c) Perform the arithmetic operations (+70) + (+80) and (−70) + (−80) with binary numbers in signed-2s complement representation. Use eight bits to accommodate each number together with its sign. Show that overflow occurs in both cases that the last two carries are unequal and there is a sign reversal.　6

7. (a) Describe, with a neat block diagram, the concept of DMA controller.　8

   (b) (i) How does MS-WINDOWS differ from MS-DOS.　4

   (ii) What are various functions of kernel of UNIX OS ?　4

   (c) Why is BIOS stored in a ROM. What do you understand by the term 'throughput' of a computer system.　2 + 2

8. (a) Distinguish between internet, intranet and extranet.　3 × 2

   (b) Explain TCP/IP with a neat diagram.　6

   (c) Explain the following : Assembler, loader, linker and interpreter.　4 × 2

Group C

9. Answer the following :　10 × 2

   (i) State Moore's law.

   (ii) What is the full form of ENIAC ?

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(*iii*) What is a Baud rate ?

(*iv*) What would be the output of the following program :

```
# define SQR(x)(x*x)
main ( )
{ int a, b = 4 ;
a = SQR (b + 3) ;
printf ("\n%d", a ) ;
}
```

(*v*) Would the following code compile successfully ? (Yes or no) What is the output ?

```
main ( )
{
printf (" % c", 6[Hindustan]) :
}
```

(*vi*) What is a NULL pointer ?

(*vii*) What would be the output of the following program :

```
main ( )
{
    char * str [  ] = {"Frogs", "Do","Not","Not",
                        "Die","They","Croak!"};
printf (" %d %d", sizeof(str[0] ));
}
```

(*viii*) What is the similarity between a structure, union and an enumeration ?

(*ix*) What would be the output of the following program ?

```
main ( )
{
print ("\n%%%");
}
```

(*x*) What do the 'c' and 'v' in argc and argv stand for ?

S'13:3FN : AN 203/AD303 (1403)

COMPUTING AND INFORMATICS

Time : Three hours

Maximum Marks : 100

Answer FIVE *questions, taking* ANY TWO *from* **Group A,**
ANY TWO *from* **Group B** *and* ALL *from* **Group C.**

*All parts of a question (a, b, etc.) should
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*Answer should be brief and to-the-point and be supplemented
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result in loss of marks.*

*Any missing or wrong data may be assumed suitably giving
proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Design an algorithm to count the number of non-zero digits in an integer. For example, for the number 42103, it should return 4. Represent your algorithm in the form of pseudo code and also in the form of a flow chart.   10

   (b) Implement the algorithm you have designed for part (a) of this question using C language.   10

2. (a) What do you understand by command line argument ? Write a C program that would take a string as its command line argument and display whether it is a palndrone or not.   10

   (b) What do you understand by a block structured language ? Is C a block structured language ? If yes, using an example, illustrate how a block can be defined in C.   10

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3. (a) What do you understand by flow control in TCP/IP ? What is the purpose of flow control ? Briefly explain how flow control is achieved in TCP/IP.   10

   (b) What is a management information system (MIS) ? Using a schematic block diagram, discuss a 3 tier architecture of an MIS. Clearly show the tier to which a DBMS would belong.   10

4. (a) Briefly describe how does electronic mail exchange work. In particular, include discussion on mail client, mail server, and the specific protocols used.   10

   (b) What do you understand by address arithmetic in C ? How can address arithmetic be used to print all the elements of the linear array ?   6

   (c) Are array arguments in a function call passed by reference or value ? Explain your answer using an example.   4

Group B

5. (a) Using a block diagram, explain the important parts of a computer and how they are interconnected.   10

   (b) Explain the components of an input/output device. Briefly explain how does the computer address an input/output device and how data transfer to/from the computer takes place. Include a suitable block diagram in your answer.   10

6. (a) What do you understand by file management ? How is file management achieved by a popular operating system such as Unix ? Explain your answer.   10

   (b) What is a virtual memory operating system ? Briefly explain how virtual memory management is achieved by the operating system.   10

7. (a) Convert the following two binary numbers into Hex and Octal numbers : 01101010 and 01011011.   10

   (b) Identify different functional and storage units of a CPU. Depict these using a block diagram and briefly explain their roles.   10

8. (a) What is a flip-flop ? For what purpose it is used for ? Explain how a flip-flop can be realized using NAND gates.   10

   (b) What is an application software ? Using suitable examples, briefly explain how an application software can invoke operating system services.   5

   (c) Identify five main advancements achieved by Window operating system over MS-DOS operating system.   5

Group C

9. Answer the following in brief :   10 × 2

   (i) In C syntax, define a structure named Student. It should contain name of the student (sting of 20 characters) and roll number (integer).

   (ii) What is the maximum number of comparison operations required to search a given integer from an array of 800 linearly ordered integers using binary search ?

   (iii) In C syntax, write a code snippet to open a file named marks. dat and print out all the marks (integer) stored in it. Assume that it contains only marks (integer) and no other data.

   (iv) Name a popular LAN protocol.

   (v) Write the truth table for a 1-bit half adder.

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(*vi*)   Explain method overloading in C^{++} using an example.

(*vii*) How is a compiler different from a language translator ?

(*viii*) Write *two* important advantages of using a DBMS as compared to using a file for storing data.

(*ix*)   Write *two* advantages of using client-server software over monolithic software.

(*x*)   Write *two* important ways in which a system software differs from an application software.

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W'13 : 3FN : AN203/AD303 (1403)

COMPUTING AND INFORMATICS

Time : Three hours

Maximum Marks : 100

Answer FIVE *questions, taking* ANY TWO *from* **Group A,** ANY TWO *from* **Group B** *and* ALL *from* **Group C.**

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Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answers may result in loss of marks.

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Figures on the right-hand side margin indicate full marks.

Group A

1. (a) What is the difference between iteration and recursion ? What are their relative advantages ? Write a program to find the value of n^m using recursion.
    2 + 2 + 4

    (b) Write a program to convert uppercase string to lowercase string without using strlwr ( ).   5

    (c) How does an inline function differ from a pre-processor macro ? Write a program to illustrate the use of object arrays.   2 + 5

2. (a) What is a destructor ? When is it invoked ? Write a program to illustrate that the destructor has been invoked implicitly by the complier.   5

    (b) What is the difference between array of integer pointers and pointer to an integer array ? Discuss with a suitable example.   3 + 3

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(c) Write a program to check whether a year is leap year or not. What do you understand by scope of a variable? What is a scope resolution operator? Give an example.   9

3. (a) What is the difference between the following two # include directives:

    # include "abc.h"

    # include <abc.h>

    Write a program to carry out the following: 4 + 4

    (i) To read a text file "INPUT.TXT"

    (ii) Print each word in the file.

(b) What is the difference between array and linked list? Create a structure to specify data on students given below:

    Roll number, Name, Department, Course, Year of joining.

    Assume that there are not more than 300 students in the college.

    (i) Write a function to print names of all students who joined in a particular year.

    (ii) Write a function to print the data on a student whose roll number is given.   2 + 10

4. (a) Write a program for conversion of a decimal number to binary number.   5

(b) What is the difference between call by value and call by reference? Discuss with a suitable example.   5

(c) Write a C function to pick the largest number from any 4 × 4 matrix.   5

(d) What do you mean by a virtual function and explain its use with a suitable example program.   5

Group B

5. (a) What do you understand by normalization of a database? What is the advantage of normalization?   7

(b) Prove, using Boolean algebra, that   6

$$(X + Y')(X + Z') = (X + Y' + Z)(X + Y' + Z)(X + Y + Z)$$

(c) Draw the logic circuit for the following expression using NAND gate only : $((XY'Z')'(XY'Z))'$.   7

6. (a) Write working principle of a CRT monitor. What is the difference between raster scan and vector scan?   3 + 3

(b) What is a batch file? Create a batch file for the following: 4 + 4
    (i) To display the current date and time
    (ii) List the files in the working directory with extension of .txt.

(c) Explain, in sequence, all the tasks performed at the time of booting up.   6

7. (a) Briefly describe client-server model and its application.   5

(b) What is the role of a modem? Discuss the concept of multiplexing and demultiplexing?   8

(c) What is a network topology? Discuss two popular network topologies with their relative advantages and disadvantages.   7

8. (a) Briefly describe OSI model for computer networks.   8

(b) Describe the following networking components: 4 × 3

    (i) Bridge

    (ii) Two layer switch

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(*iii*) Router

(*iv*) Gateways.

Group C

9. Find the outputs for (*i*) to (*vi*) and answer in brief for (*vii)* to (*x*) :   10 × 2

(*i*)   int a = 32768 ;
       printf("%d",a); (Assume integer takes two bytes of memory)

(*ii*) printf("%d", printf ("abc"));

(*iii*) int a [ ] = {1, 3, 2 } ;
       printf("%d", (a [2] + 2 [a]));

(*iv*) int a = 97 ;
       printf("%c", a);

(*v*)   int i = 0;
       for (printf ("A"), i<2;printf("C")){
           printf("B");
           i ++ ;
       }

(*vi*) int a = 5;
       printf("%d%d%d", a = = 2, a = 3, a > 5);

(*vii*) What do you mean by "throughput" of an operating system ?

(*viii*) Identify at least one factor that makes cache memory faster than main memory.

(*ix*) What do you mean by word length of a computer ?

(*x*)   What is the difference between a complier and an interpreter ?

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