ISC 2006
COMPUTER SCIENCE PAPER 1
THEORY
PART I
Answer all questions in this part

Question 1.

a) State the two Absorption Laws of Boolean Algebra. Verify any one of them using the truth table.
b) Find the complement of F(M,N,O) = M'NO' + M'N'O
c) Write the Product of Sum for the Boolean function, F(A,B,C) whose output is 0 only when:
A=1, B=0, C=0
A=0, B=1, C=0
A=0, B=0, C=1
A=1, B=1, C=1
d) Simplify AB + A'C +BC using laws of Boolean Algebra. At each step state clearly the law used for simplication.
e) Why is the NOR gate regarded as a Universal Gate? Draw the logic gate symbol and make the truth table for the two input NOR Gate.

[2 x 5 = 10]

Question 2.

a) Convert the following infix expression to its postfix form:
A + [(B+C) + (D+E)*F)]/G
b) In an array of real numbers ARR[25][25], ARR[1][1] is stored in location 1000. Find the address of ARR[12][12] when the array is stored row major wise. Assume each real number requires 4 bytes.
c) Reduce the following three input function into its simplest form:
F(X,Y,Z) = ∑(0,1,3,5)
d) Define a queue. How is a dequeue different from a queue?
e) Define encapsulation and polymorphism.

[2 x 5 = 10]

Question 3.

a) Give the output of the following program segment:-

```
class Stack
{
 final int size = 50;
 private int stak[];
 private int top;
 public Stack()
 {
    top=0;
    stak=new int[size];
  }
public void push(int x)
{
   stak[++top]= x;
  }
 public int pop()
 {
    return stak[top--];
  }
```

```
public void main()
{
   Stack s1=new Stack();
   s1.push(51);
   s1.push(27);
   s1.push(5);
   System.out.println("\n"+s1.pop());
   System.out.println("\n"+s1.pop());
   s1.push(18);
   s1.push(72);
   s1.push(517);
   System.out.println("\n"+s1.pop());
  }
}
```

b) Give the output of the following program segment:-

```
int x=0;
do
{
   if(x<3)
   {
      x+=2;
      System.out.println(x);
      continue;
    }
   else
   {
      System.out.println(++x);
      break;
    }
 }
 while(x<10);
```

[5 x 2 = 10]

PartII

Answer any seven questions in this part, choosing three questions from Section A and four questions from Section B.

Section A

Answer any three questions.

Question 4.

a) Given the Boolean function F(A,B,C,D) = ∑(1,6,7,8,9,10,14,15)

Use Karnaugh's map to reduce the function F, using the SOP form. Draw a logic gate diagram for the reduced SOP form. You may use gates with more than 2 inputs. Assume that the variables and their complements are available as inputs.

b) Given X(A,B,C,D)= ∏(0,2,3,4,5,11,12,13)

Use Karnaugh's map to reduce the function X, using the POS form. Draw a logic gate diagram for the reduced POS form. You may use gates with more than 2 inputs. Assume that the variables and their complements are available as inputs.

[5 X 2 = 10]

Question 5.

The National College of Journalism is offering courses in three different categories of journalism, which are the print, the web and the broadcasting media.

A student is eligible to apply if he/she satisfies any one of the following conditions:-

- The student is a graduate in any discipline with an aggegrate percentage of 75 or above and with a record of literary skills.

  OR

- The student is a graduate in Mass Communication with an aggregate percentage of 75 or above

The inputs are :

A	:	Graduate in any discipline
B	:	Graduate in Mass Communication
C	:	Aggregate percentage of 75 and above
D	:	Record of literary skills

Output:-

R	:	Denotes eligible to apply [1 indicates Yes and 0 indicates No in all cases]

a) Draw the truth table for the inputs and outputs given above write the SOP expression for R(A,B,C,D)

b) Reduce R(A,B,C,D) using Karnaugh map.
Draw a logic gate diagram for the reduced SOP expression for R(A,B,C,D) using AND & OR gates. You may use gates with more than 2 inputs. Assume that the variables and their complements are available as inputs.

[5 x 2 = 10]

Question 6.

a) What is a decoder? Draw the truth table and a logic circuit diagram for a 2 by 4 decoder. **[4]**

b) What is a half adder? Draw the truth table, derive its Boolean expression and draw a logic diagram for Half adder. **[6]**

Question 7.

a) What is XNOR gate? Draw a truth table representing a 2 input XNOR operation. Derive its SOP expression and draw its logic gate diagram. **[5]**

b) Write the SOP expression corresponding to the following truth table and draw its logic gate diagram. **[2]**

A	B	C	F
0	0	0	0
0	0	1	0
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	1

c) Draw the logic gate diagram for the Boolean function F(A,B,C)= (A'+B).(B'+C) making use of NOR gates only. **[3]**

Question 8.

a) Using truth table prove that

(A+B)' +(A+B')'=A'

[2]

b) Convert (X'+Y+Z').(X+Y'+Z).(X+Y+Z').(X+Y+Z) into SOP form. **[3]**

c) Prove that [(P'+Q).(Q'+R)]' + (P'+R) = 1 **[3]**

d) Differentiate between selection and insertion sort. **[2]**

Section B

Answer any 4 questions

Question 9.

A class Telcall calculates the monthly telephone bill of a consumer. Some of the members of the class are given below:

Class Name	:	Telcall
Data Members		
phno	:	phone number
name	:	name of consumer
n	:	number of calls made
amt	:	bill amount
Member functions		
Telcall( )	:	Parameterised constructor to assign values to data members
void compute()	:	to calculate the phone bill amount based on the slabs given below.
void dispdata()	:	to display the details in the specified format.

Number of calls	Rate
1-100	Rs. 500/- rental charge only
101-200	Re. 1.00/- per call + rental charge
201-300	Rs.1.20/- per call + rental charge
Above 300	Rs.1.50/- per call + rental charge

The calculation needs to be done as per the slabs.
Specify the class Telcall, giving the details of the constructor, void compute() and void dispdata().

In the main function, create an object of type Telcall and display the phone bill in the following format:

Phone number	Name	Total calls	Amount
XXXXXXXXX	XXXXX	XXXXX	XXXXX

[10]

Question 10.

A class Stock is designed to maintain the inventory of books that are being sold at a shop. Some members of the class are given below:

Class Name	:	Stock
Data members		
title		to store the book title
author		to store author's name
publisher		to store publisher name
noc	:	total number of copies available
price	:	unit price per copy
Member functions		
Stock()	:	constructor to assign values to data members
void check(String tit, String auth,int n)		check title, author, number of copies required. If available , find the total price and update the stock. If not available display the appropriate message.
void disp()	:	to display title, author, publisher, unit price of book, total price to be paid for copies required and the remaining in stock.

Write a program defining a class Stock and giving details of the constructor and other functions. **[10]**

Question 11.

A ticket at a ticket selling booth at a fair is priced at Rs. 2.50/-. The booth keeps track of the total number of people who have visited the booth, the number of people who have actually purchased a ticket and the total amount of money collected. Design a class called Ticbooth which includes the following Members:

Class name	:	Ticbooth
Data members		
no_people	:	number of people who have visited the booth
amount	:	total amount of money collected
Member functions		
void intial()	:	to assign initial values to data members
void notsold()	:	increment total number of people only visiting the booth and not purchasing a ticket.
void sold()	:	increment total number of people purchasing a ticket and amount collected when ticket is sold.
void disp_totals()	:	to display total number of people visiting the booth (the total number of people purchasing the ticket as well as those not purchasing a ticket).
void disp_ticket()	:	to display the total number of tickets sold and the amount collected.

Specify the class Ticbooth giving details of functions void initial(), void sold(), void notsold(), void disp_totals() and void disp_ticket(). The main function need not be written. **[10]**

Question 12.

A class Hifact has been defined to find the HCF of two numbers using the recursive technique. This HCF is used to find the LCM of two numbers. Some members of the class are given below:-

Class name	:	Hifact
Data members		
a		
b		
hcf		
lcm	:	integers
Member functions		
Hifact()	:	constructor to assign initial values to data members
void getdata()	:	to input values of a and b
void change()	:	to swap a and b if a> b
int rechcf(int, int)	:	to find hcf using recursive technique
int fn_lcm(int,int,int)	:	to find lcm using a,b and hcf
void result()	:	to invoke rechcf() and fn_lcm() and to print lcm, hcf of the two numbers a and b.

Specify the class Hifact giving details of constructor, void getdata(), void change(), int rechcf() and int fn_lcm(). Write the main function and find the hcf and lcm of any two integers a and b. **[10]**

Question 13.

A class Sort contains an array of 50 integers. Some of the member functions/ data members are given below:

Class name	:	Sort
Data members		
arr[]	:	integers
item	:	number to be searched for in the array
Member functions		
void inpdata()	:	to input 50 integers (no duplicate number to be entered)
void bubsort()	:	to sort the array in ascending order using the bubblesort technique And to display the sorted list.
void binsearch()	:	to input item and search for it using the binary search technique; if found to print the item searched and its position in the sorted list, otherwise to print an appropriate message.

Specify the class Sort giving details of the functions void inpdata(), void bubsort() and void binsearch(). The main function need not be written.

[10]

Question 14.

Design a class Stringfun to perform various operations on strings without using built –in functions except for finding length of the string. Some of the member functions and data members are given below:

Class name	:	Stringfun
Data members		
str	:	to store a string
Member functions		
void input()	:	to accept the string
void words()	:	to find and display the number of words, number of vowels and number of uppercase characters in the string.
void frequency()	:	to display the frequency of each character within the string.

Specify the class Stringfun giving details of the functions void input(), void words() and void frequency(). You do not need to write the main function.

[10]