

Your Roll No.

6601

B.Sc. (Hons.) COMPUTER SCIENCE/I Sem. B

Paper CSHT 101 : Programming Fundamentals

Time : 3 Hours.

Maximum Marks : 75

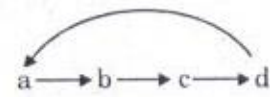
(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt All questions.

Parts of the questions must be attempted together.

Mention the assumptions made in your answers.

1. (a) What do you understand by top-down design approach ? 3
- (b) With the help of an example, explain the divide-and-conquer strategy. 3
- (c) Design an algorithm that makes the following exchanges :



The arrows indicate that b is to assume the value of a, c the value of b, and so on. 3

P.T.O.

- (d) Briefly explain the different types of computer software. 3
- (e) Interpret the following 32-bit floating point number represented in Excess-127 format : 3
- 1 11110110 101011000000000000000000
2. Differentiate between the following (giving appropriate examples) :
- (i) lvalue and rvalue
- (ii) runtime and compile time polymorphism
- (iii) copy constructor and overloaded assignment operator
- (iv) call by value, call by reference and call by pointers
- (v) enumerated data type and typedef statement. 3×5

3. (a) Given the following definition. What data members and functions are directly accessible by the function void info(void) ? 3

```
class XX
{
    int a;
    float b;
    void initial(int);
public:
    char ch;
    get( );
protected:
    float amount;
    getamount(int);
    friend sum(int, int);
};
class YY : public XX
{
    int X;
public:
    int j;
    read ( );
protected:
    void info(void);
    friend void B (void);
};
void display( );
```

(b) What will be the output of the following code segments ?

Justify your answers.

(i) void main()

```
{
int a = 120, b = -123;

cout.setf(ios::right, ios::adjustfield);

cout.width(12);

cout.fill('&');

cout<<b<<endl;

cout.setf(ios::left, ios::adjustfield);

cout.width(12);

cout.fill('*');

cout<<a<<endl;

cout.setf(ios::internal, ios::adjustfield);

cout.width(12);

cout.fill('#');

cout.<<b;

}
```

3

(ii) int x = 0, y = 0, z = 1;

```
if (z < x || y >= z && z == 1)
```

```
    if (z && y)
```

```
        y = 1;
```

```
    else
```

```
        x = 1;
```

```
cout << x <<" "<< y <<" "<<z;
```

3

(iii) typedef void v;

```
typedef int i;
```

```
v test(i m, i n)
```

```
{
```

```
    i s = 4;
```

```
    double i;
```

```
    i = m;
```

```
    cout<<sizeof(i);
```

```
    cout<<m<<s*s;
```

```
}
```

```
int main( )
```

```
{
```

```
    test(7, 6);
```

```
}
```

3

P.T.O.

(iv) string s1 = "Hello", s2 = "There!!!", s3 = "How
are you ?", s;

s = s1 + " " + s2 + " " + s3;

cout<<s<<endl;

cout<<s.find_last_of('o', s.length() - 6); 3

4. (a) Write a program that accepts the name of a file and displays the number of words in the file. 6

(b) A C++ program contains the following declaration :
static int x[8] = {100, 200, 300, 400, 500, 600, 700, 800};

(i) What does (x + 2) indicate ?

(ii) What will be the values of the following ?

(1) * x

(2) (* x + 2)

(3) *(x + 2). 4

(c) If four objects of a class are defined, how many copies of class data items are stored in the memory and how many copies of its member functions ? 2

(d) What are virtual functions ? Is it possible to declare an object of a class that contains a virtual function ? Justify your answer. 3

5. (a) Identify the errors in the following code segments. Also mention how those errors can be removed. 2

(i) float real[3];
real[0] = 121.2;
real[1] = 21,24;
real[3] = 67.2;
ptr = ℜ
cout<<*ptr;

(ii) class ABC
{
private:
...
public:
int ABC (int x);
};

(iii) class x {...};
class y {...};
class z {...};
void fun() throw (x,y)
{
throw z();
...
}

(iv) void PQR :: operator ? : (int x, int y, int z)

{.....}

1

(v) void fun (int x, int y)

{

int z;

∴

return z;

}

1

(b) Write a function that accepts two arrays of same size and the size is also passed as an argument. The function should return 'true' if corresponding elements of two arrays are same else it should return 'false'. 3

(c) Define a base class vehicle and its two derived classes : Car and Scooter. Write a program to ask the user for the type of vehicle and then using the concept of runtime polymorphism, display the message "It is a two-wheeler" for scooter and "It is a four-wheeler" for car. 6

This question paper contains 7 printed pages]

Your Roll No.....

6602

B.Sc.(Hons.) Computer Science/I Sem. B

Paper CSHT-102 : Discrete Structures

(Admissions of 2011 and onwards)

Time : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *all* the questions.

Parts of a question must be performed together.

Use of Scientific Calculator is allowed.

1. (a) A TV survey shows that 60 percent people see program A, 50% see program B, 50% see program C, 30% see program A and B, 20% see program B and C, 30% see program A and C and 10% do not see any program.

Find :

(i) What % see program A, B and C ?

(ii) What % see program A only ?

4

P.T.O.

- (b) Show that any integer composed of 3^n identical digits is divisible by 3^n using Mathematical Induction. 4
- (c) Find $f \circ g$ and $g \circ f$, where $f(x) = x^2 + 1$ and $g(x) = x + 2$, are functions from \mathbb{R} to \mathbb{R} . 4
2. (a) Show that the relation \leq (less than or equal to) defined on the set of positive integers is a partial order relation. 3

- (b) Let a be a numeric function such that :

$$a_r = \begin{cases} 2 & 0 \leq r \leq 3 \\ 2^{-r} + 5 & r \geq 4 \end{cases}$$

Determine ∇a and Δa . 4

- (c) Solve the recurrence relation

$$a_{n+2} - 3a_{n+1} + 2a_n = 0$$

by the generating function method with initial conditions

$$a_0 = 2 \text{ and } a_1 = 3. \quad 5$$

- (d) Use Master method to give tight asymptotic bounds for the following Recurrence relation

$$T(n) = 4T(n/2) + n^3. \quad 2$$

3. (a) Show the equivalence

$$\neg(p \vee q) \vee (\neg p \wedge q) \equiv \neg p. \quad 3$$

- (b) Prove the conclusion from the given sets of premises

$$P \rightarrow (Q \rightarrow R), Q \rightarrow (R \rightarrow S) \Rightarrow P \rightarrow (Q \rightarrow S). \quad 5$$

- (c) Translate these statements into English.

Let $P(x, y) = 'x \text{ has sent a letter to } y'$, where universe of discourse of both x and y consists of all students in a class.

(i) $\exists y \exists x P(x, y)$

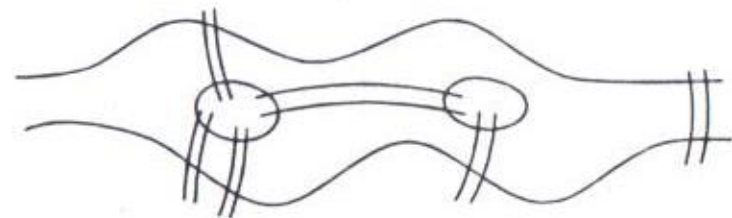
(ii) $\forall x \exists y P(x, y).$ 4

- (d) Verify that the proposition $p \vee \neg(p \wedge q)$ is a tautology. 3
4. (a) Evaluate the sum 3

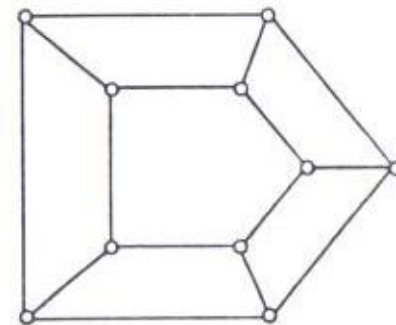
$$\sum_{k=1}^{\infty} (2k+1)x^{2k}$$

- (b) How many different ways are there to select 4 different players from 10 players on a team to play four tennis matches, where the matches are ordered. 3
- (c) Show that among any group of five integers, there are at least two integers with the same remainder when divided by 4. 3
5. (a) Suppose that a connected planar simple graph has 20 vertices, each of degree 3. Into how many regions does a representation of this planar graph split the plane? 2

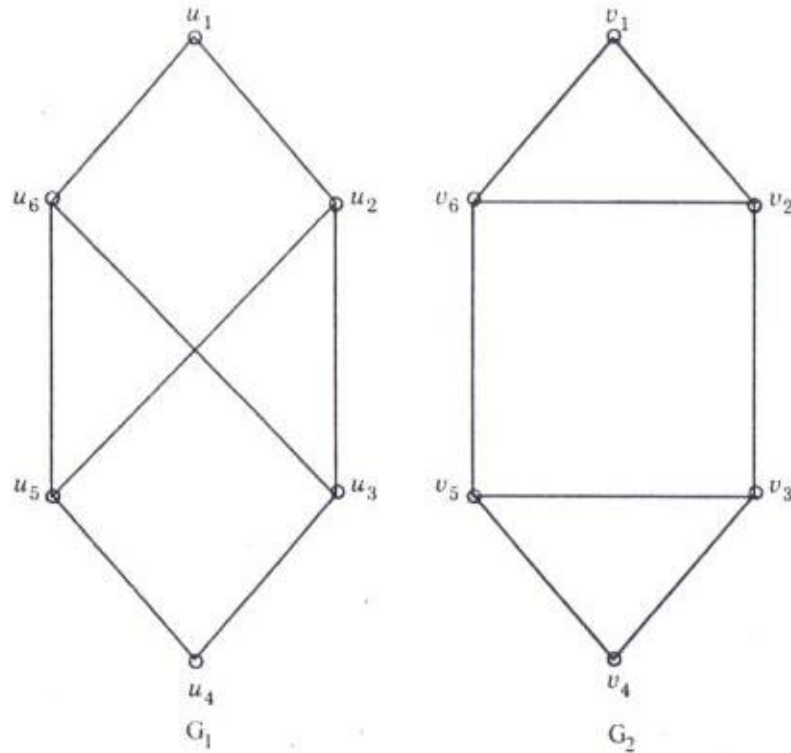
- (b) How many vertices does a full 5-ary tree with 100 internal vertices have? 2
- (c) Can someone cross all the bridges shown in this map exactly once and return to the starting point? If so, determine the path? 4



- (d) Derive an expression for the chromatic number of C_{mn} where $n > 3$. C_{mn} is a graph with two concentric cycles and n vertices, connected as shown below: 3



(e) Determine whether G_1 and G_2 are isomorphic or not ? 4



6. (a) Suppose that the no. of bacteria in a colony triples every hour. 3

(i) Set up a recurrence relation for the number of bacteria after n hours have elapsed.

(ii) If 100 bacteria are used to begin a new colony, how many bacteria will be in the colony in 10 hours ?

(b) Show that :

$$x^2 + 4x + 17$$

is $O(x^3 - 2x^2 - 5)$.

4

(c) Show that if

$f(n) = O(g(n))$ and $f(n) = \Omega(g(n))$ then

$$f(n) = \Theta(g(n)).$$

3

This question paper contains 8 printed pages]

Your Roll No.

5180

B.Sc. (PHYSICAL SCIENCE)/1st Sem. B

Paper MAPT-101

Mathematics-I (Calculus and Matrices)

(Admission of 2010 and onwards)

Time : 3 Hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any two questions from each Section.

Section I

1. (a) Verify that the set

$$\left\{ \begin{bmatrix} \pi \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ e \end{bmatrix} \right\}$$

of vectors is a basis of R^2 . 6

P.T.O.

(b) Examine which of the following is a subspace of R^2 . If it is a subspace, give its geometric interpretation :

$$V_1 = \{(a, 2a) : a \in R\}$$

$$V_2 = \{(a, b) : a > 0, a, b \in R\}. \quad 6$$

2. (a) Let $T : R^3 \rightarrow R^2$ be a linear transformation such that $T(1, 0, 1) = (2, -1)$, $T(0, 1, 1) = (1, 1)$, and $T(1, 1, 0) = (-1, 4)$. Find $T(1, 1, 1)$. 6

(b) Let R be the rectangle with vertices (1, 1), (1, 4), (3, 1) and (3, 4). Determine and sketch the image of R under :

(i) a reflection about the y-axis.

(ii) a translation by vector (1, 1). 6

3. (a) Reduce the matrix

$$A = \begin{bmatrix} 2 & 3 & 3 \\ 3 & 6 & 12 \\ 2 & 4 & 8 \end{bmatrix}$$

to triangular form by elementary row operations and hence determine its rank. 6

- (b) Find the characteristic equation, eigen values and eigen vector corresponding to one of them for the matrix

$$A = \begin{bmatrix} 1 & 2 & -1 \\ 1 & 0 & 1 \\ 4 & -4 & 5 \end{bmatrix} \quad 6$$

4. (a) Solve the system of equations :

$$x + 2y - z = 3$$

$$3x - y + 2z = 1$$

$$2x - 2y + 3z = 2. \quad 6$$

- (b) For what values of λ and μ do the following system of equations :

$$x + y + z = 6$$

$$x + 2y + 3z = 10$$

$$x + 2y + \lambda z = \mu$$

have an infinite number of solutions. 6

P.T.O.

Section II

5. (a) Discuss the convergence of a sequence :

$$\left\langle \frac{n}{3n+1} \right\rangle \quad 6$$

- (b) Find the n th derivative of

$$y = \frac{x+1}{x^2-4} \quad 6$$

- (c) If

$$y = e^{m \sin^{-1} x},$$

show that :

$$(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2+m^2)y_n = 0. \quad 6$$

6. (a) Sketch the graph of a function :

$$f(x) = -(x+2)^2 + 3. \quad 6$$

- (b) Find the Maclaurin series expansion of $y = \cos 2x$, assuming that :

$$\lim_{n \rightarrow \infty} R_n(x) = 0. \quad 6$$

- (c) In a school, there are 1000 students and all are likely to get infected with eye-flu virus. Initially, 20 students got infected and within 2 weeks, 100 students got infected with the disease. In how much time would the majority of students be infected by the eye-flu virus? It is given that the disease spreads with logistic growth model. 6

7. (a) Draw the level curves of height $k = 0, 1, 2$ for the surface :

$$z = f(x, y) = 5\sqrt{\frac{x^2}{16} + \frac{y^2}{9}} - 1. \quad 6$$

- (b) If $v = r^m$, where $r^2 = x^2 + y^2 + z^2$, show that :

$$\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} + \frac{\partial^2 v}{\partial z^2} = m(m+1)r^{m-2}. \quad 6$$

P.T.O.

- (c) Verify that the function :

$$w = \cos(5x + 5ct)$$

is a solution of the wave equation. 6

8. (a) For what values of x can we replace $\sin x$ by $x - \frac{x^3}{6}$ with an error of magnitude no greater than 3×10^{-4} . 6

- (b) Verify which of the following sequences are monotonic and bounded :

(i) $\left\langle \frac{2^n}{n!} \right\rangle$ 6

(ii) $\langle n - 2^n \rangle$. 6

Section III

9. (a) Find the radius and centre of the circle whose equation is :

$$z\bar{z} - (2 + 3i)z - (2 - 3i)\bar{z} + 9 = 0. \quad 3\frac{1}{2}$$

- (b) Form an equation in the lowest degree with real coefficients which has $2 - 3i$ and $3 + 2i$ as two of its roots. 4

10. (a) Find the modulus and argument of the centroid of the triangle whose vertices are given by $8 + 5i$, $-3 + i$ and $-2 - 3i$, respectively. $3\frac{1}{2}$

- (b) Let z_1, z_2, z_3 be complex numbers such that $z_1 + z_2 + z_3 = 0$ and $|z_1| = |z_2| = |z_3| = 1$. Prove that :

$$z_1^2 + z_2^2 + z_3^2 = 0. \quad 4$$

11. (a) If $x = \cos \theta + i \sin \theta$ and $y = \cos \phi + i \sin \phi$, prove that :

$$\frac{x - y}{x + y} = i \tan \frac{\theta - \phi}{2}. \quad 4$$

- (b) Use De Moivre's theorem to solve the equation :

$$z^7 + z = 0. \quad 3\frac{1}{2}$$

12. (a) Find the inverse of the matrix

$$A = \begin{bmatrix} 2 & 4 & 6 \\ 3 & 1 & 2 \\ 0 & 1 & -1 \end{bmatrix}$$

using elementary operations. 4

- (b) Express vector $X = (3, 1, -4)$ as a linear combination of the vectors $X_1 = (1, 1, 1)$, $X_2 = (0, 1, 1)$ and $X_3 = (0, 0, 1)$. $3\frac{1}{2}$

This question paper contains 3 printed pages.

6659

Your Roll No.

B.Sc. (Hons.) (Computer Science) / I Sem.

B

Paper 104— DIGITAL ELECTRONICS

(Admissions of 2001 and onwards)

Time : 3 hours

Maximum Marks : 75

(Write your Roll No. on the top immediately on receipt of this question paper.)

Section A is compulsory. Attempt any four questions from Section B.

Section A

- 1 a) Find the hexadecimal, gray code and excess 3 code equivalents of decimal number 431. (3)
- b) Perform the following subtractions using 2s complement arithmetic :-
 - i) $(256)_{10} - (34)_{10}$
 - ii) $(-56)_8 - (36)_8$ (2)
2. Simplify the following function in Product of Sum form (use Karnaugh Map)
 $F(A,B,C,D) = \sum m(2,3,6,7,8,9,12,13) + \sum d(4,10,14)$ (5)
3. Implement the following function using 8x1 Multiplexer:
 $F(A,B,C,D) = \prod (0,1,3,4,8,9,15)$ (5)
4. Design a code converter that converts a decimal digit from 2421 code to BCD. (5)
5. a) Convert a D flip flop into a JK flip flop. (2)
b) What is race condition of a J-K flip flop? In how many ways can this condition be removed? (3)
6. Design a circuit for synchronous mod-5 counter. (5)
7. a) A 8-bit computer has a main memory with the capacity of 64Kbytes. Calculate the following:
 - i) How many words are stored in the memory?
 - ii) What is the highest address in hexadecimal? (2)

Turn over

b) Design a circuit for 3-bit even parity generator. (3)

Section B

8. a) Simplify the following Boolean function using Quine Mc-Clusky method:

$$F(A,B,C,D) = \sum m(0,2,3,6,8,10,11,12,13,14) + \sum d(9,15)$$

Determine essential prime implicants. (6)

b) Implement the function F with the following two level forms:

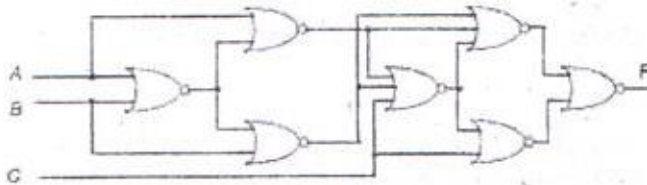
$$F(A,B,C,D) = \sum(0,1,2,3,4,8,9,12)$$

i) NAND-NAND

ii) NAND-AND (4)

9. a) Design a Full Adder using two half Adders. (3)

b) Analyze and determine the function implemented the circuit given below.



(5)

c) Define the fundamental mode operation in asynchronous circuits. (2)

10 a) Given the 8 bit data word 01011011, show the steps to generate the 13 bit composite word for the hamming code that corrects single error and detects double error. (4)

b) Differentiate between a decoder and an encoder. Give the truth table and the circuit for a 4-bit priority encoder. (2+4)

11. a) A sequential circuit has two flip-flops (A and B), one input X, and two outputs Y and Z. The flip-flop input functions and the output functions are:

$$\begin{aligned} JA &= B & JB &= XA' + X'A & Y &= A' + B \\ KA &= XB & KB &= X' & Z &= X'B + XA'B' \end{aligned}$$

Obtain the state equations, the transition (state) table, the transition (state) diagram, and the circuit diagram. (7)

b) Differentiate between synchronous and asynchronous counter. (3)

12. a) For the synchronous sequential circuit described by the following state table, derive the output sequence for the input sequence $X = 0010011$, assuming that the starting state is:

(i) A (ii) D

Present State	Next State		Output	
	X=0	X=1	X=0	X=1
A	B	C	1	1
B	D	D	1	0
C	B	C	0	1
D	C	A	0	1

(4)

b) A PQ flip flop has 4 operations set 0,1,no change and complement when P and Q inputs are 00,01,10 and 11 respectively. Tabulate its characteristic table and excitation table. Derive its characteristic equation. (4)

c) Draw the logic symbol of a 4kx4 RAM with common input/output pins and an active low chip enable. (2)

13. a) Construct a 32X1 MUX using four 8X1 MUX and a 4X1 MUX. Use block diagrams only. (4)

b) Give the block diagram for a 3-bit synchronous sequential circuit which has following capabilities:

- i) Parallel Load
- ii) Right Shift
- iii) Left shift

(6)