

- N. B.: (1) All questions are compulsory.
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 (3) Answers to the same question must be written together.
 (4) Numbers to the right indicate marks.
 (5) Draw neat labeled diagrams wherever necessary.
 (6) Use of Non-programmable calculators is allowed.

1. Attempt any three of the following: 15
- What are the steps involved for Measuring of carbon footprint?
 - How hardware deployments can affect the environment?
 - Write a note on Equipment Disposal.
 - What are the steps taken by JAPAN for managing their own e-waste problem?
 - What are the Basel Action Network functions?
 - Explain any five e-waste laws of states in US.
2. Attempt any three of the following: 15
- Write a note on Data De-Duplication and Virtualization.
 - Explain MAID and RAID.
 - What is polling? Give example.
 - List and explain the issues regarding power consumption and cooling costs.
 - Explain Hot Aisle (path)/Cold Aisle and Raised Floors.
 - List and explain datacenters design and decision making issues.
3. Attempt any three of the following: 15
- List and explain decision making pyramid with its levels.
 - Which things are necessary for environmentally preferable purchasing plan?
 - How to find out which products have low levels of toxins?
 - Which things are needed to go paperless in organization?
 - What is the use of Microsoft Office SharePoint Server 2007? List its features.
 - What is Value Added Network? Give its benefits.
4. Attempt any three of the following: 15
- Explain the recycling problems in China and Africa.
 - How to determine the system's long life?
 - Which are benefits to leasing the equipment?
 - Write a short note on Electronic Product Environmental Assessment Tool(EPEAT) certification.
 - What is Blade server? Give its benefits.
 - What is the use of Remote Desktop? Explain its components.
5. Attempt any three of the following: 15
- How CRM segregate the people of organization in group?
 - What are the steps involved for good green procurement program?
 - Explain characteristics of Software as a Service.
 - Explain transitioning four-step process.
 - Write a note on SMART goals.
 - Which steps are involved to conduct energy audit?



FYBSCC(ITT)

(Time: 2 1/2 hours)

[Marks: 75]

Please check whether you have got the right question paper.

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1. Attempt **any three** of the following: 15
- a. What is procedure oriented Programming? What are its characteristics?
 - b. Differentiate between Object Oriented and Procedure Oriented Programming paradigms.
 - c. Discuss the need and advantages of Object Oriented Programming.
 - d. Discuss various applications of Object Oriented Programming.
 - e. What do you mean by Dynamic and static binding.
 - f. Write a short notes on (i)Object (ii)Class
2. Attempt **any three** of the following: 15
- a. What is a class? Illustrate the use of class with a simple c++ program.
 - b. What are inline functions? How an outside function can be made inline?
 - c. What is a constructor? Explain its characteristics. List various types of constructors?
 - d. What are friend functions? What are their characteristics? Write a small program to illustrate the use of a friend function.
 - e. Explain the use of parameterized constructors with a programming example.
 - f. What do you understand from nesting of member functions? Explain with suitable programming example.
3. Attempt **any three** of the following: 15
- a. What is function overloading? Explain with suitable example.
 - b. What is operator overloading? List the operators which can be overloaded and which cannot be overloaded.
 - c. Write a c++ program to overload unary minus operator.
 - d. What are virtual functions? Explain.
 - e. Define the following
 - (i) Abstract Class
 - (ii) Pure Virtual Function
 - f. What is a **this** pointer? Write a program to illustrate its use.

[TURN OVER]

4. Attempt ***any three*** of the following: 15
- a. What do you understand from the concept of inheritance? Explain its various types.
 - b. Explain the use of various visibility modes used in inheritance.
 - c. Discuss the role of constructors in derived classes in detail.
 - d. What is an exception? What are advantages of exception handling mechanism in a program?
 - e. Explain the concept of throw and catch with suitable example.
 - f. Write a c++ program to illustrate multilevel inheritance.
5. Attempt ***any three*** of the following: 15
- a. What are class templates? Explain their use. How a class template can be declared?
 - b. Explain function template with a programming example.
 - c. Write a c++ program to implement bubble sort using function template.
 - d. Explain the working of files in c++.
 - e. Explain various methods to detect end of file in a c++ program.
 - f. Explain the following
 - (i) seekg()
 - (ii) seekp()
-

(2½ Hours)

[Total Marks: 75]

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1. Attempt **any three** of the following: 15

- What is WWW? Write difference between WWW and Internet.
- List and explain different types of CSS selectors with example.
- Write short note on Uniform Resource Locator.
- Explain the following HTML tags with the help of example:
 (i)
 (ii)<pre> (iii) <h6> (iv) <p> (v) <a>
- What is proxy server? Discuss its application with reference to internet.
- Explain different types of lists available in HTML with the help of example.

2. Attempt **any three** of the following: 15

- How to format and position a division on a web page? Explain with example.
- Write HTML code to design given web page using Table tags.

Sales Report			
ITEM CODE	UNITS	RATE	SALES
1	2	100	200
2	5	50	250
3	10	250	2500
Total Sales			2950

- How will you create graphical navigation bar? Explain with example.
- Explain <audio> and <video> tags in HTML 5.
- Write HTML Code to design a web page with Image Maps.
- List and explain any five HTML Form controls with example.

3. Attempt **any three** of the following: 15

- Write a short note on "for...in" looping statement in JavaScript.
- Write a program in JavaScript to accept a sentence from the user and display the number of words in it. (Do not use split () function).
- Explain following events:
 (i)onclick (ii) onfocus (iii) onmouseover (iv) onload (v) onerror
- Write a JavaScript program using various methods of Date Object.
- Write a short note on comparison and logical operators in JavaScript.
- List various features of JavaScript.

4. Attempt **any three** of the following: 15

- What is PHP? Write the advantages of using PHP for server-side web scripting.
- Write a PHP code to find the greater of two numbers. Accept the numbers from the user.

[TURN OVER]

- c. Explain any five string functions available in PHP with example.
- d. What are the different methods available in PHP for passing the information from one page to another? Explain.
- e. Write a short note on PHP data types.
- f. Explain associative array in PHP with the help of example.

5. Attempt *any three* of the following:

15

- a. Explain following PHP/MYSQL functions:
(i) `mysql_connect ()` (ii) `mysql_close ()` (iii) `mysql_query ()`
(iv) `mysql_select_db ()` (v) `mysql_error ()`
- b. Write a PHP program to demonstrate the use of cookies in PHP.
- c. Compare POSIX and PERL style Regular expressions of PHP.
- d. List various HTTP functions available in PHP. Explain `header ()` function in detail.
- e. Write a PHP program to create a database named "employee". Create a table named "salary" with following fields (eid, ename, esalary). Insert 3 records of your choice. Display the names of the employees whose salary is between 15000 to 20000 in a tabular format.
- f. Write a short note on PHP Session.

(2½ Hours)

[Total Marks: 75]

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1. Attempt **any three** of the following: 15

- a. State the characteristics of typical mathematical models of physical world. Explain with example.
- b. Discuss the conservation laws and engineering with respect to mathematical models.
- c. Suppose that you have the task of measuring the lengths of a-bridge and a rivet and come up with 9999 and 9 cm, respectively. If the true values are 10,000 and 10 cm, respectively, compute (i) the true error and (ii) the true percent relative error for each case.
- d. Use zero- through third-order Taylor series expansions to predict $f(3)$ for $f(x) = 25x^3 - 6x^2 + 7x - 88$ using a base point at $x = 1$.
- e. Determine the absolute and relative errors when approximating p by p^* when
 - i. $p = 0.3000 \times 10^1$ and $p^* = 0.3100 \times 10^1$
 - ii. $p = 0.3000 \times 10^{-3}$ and $p^* = 0.3100 \times 10^{-3}$
 - iii. $p = 0.3000 \times 10^4$ and $p^* = 0.3100 \times 10^4$
- f. Let $p = 0.54617$ and $q = 0.54601$. Use four-digit arithmetic to approximate $p - q$ and determine the absolute and relative errors using (i) rounding and (ii) chopping.

2. Attempt **any three** of the following: 15

- a. Use the Bisection method to find solutions accurate to within 10^{-2} for $x^3 - 7x^2 + 14x - 6 = 0$ in the interval $[3.2, 4]$.
- b. The fourth-degree polynomial $f(x) = 230x^4 + 18x^3 + 9x^2 - 221x - 9$ in $[0, 1]$ correct upto 4 decimal places using Regula-Falsi method.
- c. Find the root of $4x^2 - e^x - e^{-x} = 0$ using Newton Raphson correct upto 4 decimal places using initial value as 1.
- d. Given the cube of integers in the following table. Find the values of $(5.5)^3$ and 15^3 using Newton's interpolation formula.
- e. Find $f(0.9)$ if $f(0.6) = -0.17694460$, $f(0.7) = 0.01375227$, $f(0.8) = 0.22363362$, $f(1.0) = 0.65809197$ using Lagrange's Interpolation formula.
- f. Using appropriate interpolation formula find $f(4.25)$ from the table:

X	4.0	4.1	4.2	4.3	4.4	4.5
$f(x)$	27.21	30.18	33.35	36.06	40.73	54.01

[TURN OVER]

3. Attempt any three of the following:

a. Solve the following system by using the Gauss-Jordan elimination method.

$$\begin{aligned} a + b + 2c &= 1 \\ 2a - b + d &= -2 \\ a - b - c - 2d &= 4 \\ 2a - b + 2c - d &= 0 \end{aligned}$$

b. Solve the following system by using the Gauss-Seidel iterative method.

$$\begin{aligned} 10a - b + 2c &= 6 \\ -a + 11b - c + 3d &= 25 \\ 2a - b + 10c - d &= -11 \\ 3b - c + 8d &= 15 \end{aligned}$$

c. Find $\left(\frac{dy}{dx}\right)_{x=5.2}$, if

x	4.9	5.0	5.1	5.2	5.3	5.4	5.5
y	134.290	148.413	164.022	181.272	200.337	221.406	244.692

d. Evaluate $\int_0^{0.3} \sqrt{1 - 8x^2} dx$ using Simpson's 3/8th rule.

e. Apply Taylor's method of order two with $N = 10$ to the initial-value problem

$$y' = y - t^2 + 1, 0 \leq t \leq 2, y(0) = 0.5$$

f. Using modified Euler's method find the solution of

$$y' = \cos 2t + \sin 3t, \quad 0 \leq t \leq 1; y(0) = 1 \text{ with } h = 0.25$$

4. Attempt any three of the following:

a. Fit an exponential model to:

x	0.4	0.8	1.2	1.6	2.0	2.3
y	800	975	1500	1950	2900	3600

b. Find the least square polynomial approximation of degree two to the data

x	0	1	2	3	4
y	-4	-1	4	11	20

c. Find the best-fit values of a and b so that $y = a + bx$ fits the data given in the table.

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.3

d. A painter has exactly 32 units of yellow dye and 54 units of green dye. He plans to mix as many gallons as possible of color A and color B. Each gallon of color A requires 4 units of yellow dye and 1 unit of green dye. Each gallon of color B requires 1 unit of yellow dye and 6 units of green dye. Find the maximum number of gallons he can mix graphically.

e. Rita wants to buy x oranges and y peaches from the store. She must buy at least 5 oranges and the number of oranges must be less than twice the number of peaches. An orange weighs 150 grams and a peach weighs 100 grams. Joanne can carry not more than 3.6 kg of fruits home.

i) Write 3 inequalities to represent the information given above.

ii) Plot the inequalities on the Cartesian grid and show the region that satisfies all the inequalities. Label the region S .

iii) Oranges cost ₹ 0.70 each and peaches cost ₹ 0.90 each. Find the maximum that Rita can spend buying the fruits.

[TURN OVER]

- f. Consider a calculator company which produces a scientific calculator and a graphing calculator. Long-term projections indicate an expected demand of at least 1000 scientific and 800 graphing calculators each month. Because of limitations on production capacity, no more than 2000 scientific and 1700 graphing calculators can be made monthly. To satisfy a supplying contract, a total of at least 2000 calculators must be supplied each month. If each scientific calculator sold results in Rs.120 profit and each graphing calculator sold produces a Rs.150 profit, how many of each type of calculators should be made monthly to maximize the net profit?

5. Attempt any three of the following:

15

- a. The mileage C in thousands of miles which car owners get with a certain kind of tyre is a random variable having probability density function

$$f(x) = \frac{1}{20} e^{-\frac{x}{20}} \quad \text{for } x > 0 \\ = 0, \quad \text{for } x \leq 0$$

Find the probabilities that one of these tyres will last

- At most 10000 miles
 - Anywhere from 16000 to 24000 miles
 - At least 30000 miles
- b. A petrol pump is supplied with petrol once a day. If its daily volume X of sales in thousands of litres is distributed by

$$f(x) = 5(1-x)^4, 0 \leq x \leq 1$$

what must be the capacity of its tank in order that the probability that its supply will be exhausted in a given day shall be 0.01?

- c. A continuous random variable X has a p.d.f.

$$f(x) = 3x^2, 0 \leq x \leq 1$$

Find a and b such that

- $P(X \leq a) = P(X > a)$ and
 - $P(X > b) = 0.05$
- d. What is the probability of getting a total of 9 (i) twice and (ii) at least twice in 6 tosses of a pair of dice?
- e. In a precision bombing attack there is a 50% chance that any one bomb will strike the target. Two direct hits are required to destroy the target completely. How many bombs must be dropped to give a 99% chance or better of completely destroying the target?
- f. A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as Poisson variate with mean 1.5. Calculate the proportion of days on which (i) neither car is used, and (ii) some demand is refused.



BSCIT
29/11/18

FY BSCIT SEM-1 2018

Paper / Subject Code: 82301 / Imperative Programming

(2½ Hours)

[Total Marks: 75]

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1. **Attempt any three of the following:** 15
a. Explain the different types of programming language.
b. Explain the different steps in the program development cycle.
c. Draw the flowchart and pseudo code of program that doubles a number.
d. Describe the structure of a C program.
e. What are the various data types in C? Explain them.
f. What is a statement in C? Explain the different classes of statement in C.
2. **Attempt any three of the following:** 15
a. Write a program in C to swap two numbers without using third variable.
b. Describe the five arithmetic operators in C.
c. Explain the conditional operator in C.
d. Explain the getchar and putchar functions used in C programming language.
e. Write a short note on scanf function.
f. Explain the gets and puts functions used in C programming language.
3. **Attempt any three of the following:** 15
a. Explain if-else statement with an example.
b. Write a program in C to find the sum of squares of digits of a number.
c. What is the difference between while and do-while loop in C?
d. Explain the function with an example.
e. Write a program in C to find the factorial of a number using recursion.
f. Explain call by value and call by reference.
4. **Attempt any three of the following:** 15
a. What is meant by the storage class of a variable?
b. Write a short note on Global variable.
c. Write a program in C to calculate successive Fibonacci numbers.
d. What are preprocessor directives in C? Explain #include and #define in C.
e. Write a program in C to arrange the 'n' numbers stored in the array in ascending order.
f. What is a two dimensional array? How can they be declared and initialized in C?
5. **Attempt any three of the following:** 15
a. Explain the term pointers with an example.
b. Write a C program to perform addition of two pointer variable.
c. Write a short note on pointer arithmetic.
d. Differentiate between structure and union.
e. What is an array within the structure and array of structure?
f. Explain nested structure in C with an example.

FY-BSC-15
3/12/18

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1. **Attempt any three of the following:** 15
 - a. What is Operating System? Explain the role of operating system as extended machine.
 - b. Write a short note on Fifth Generation of Operating System.
 - c. Explain multithreaded and multi-core chips.
 - d. Using suitable diagram explain the structure of disk drive.
 - e. Write a short note on Process Model.
 - f. Explain the dining philosopher's problem.

2. **Attempt any three of the following:** 15
 - a. Explain the concept of running multiple programs without memory abstraction.
 - b. How swapping helps to hold large programs in RAM? Explain Using suitable diagram.
 - c. Explain Clock page replacement algorithm using suitable example.
 - d. List and explain any five operations performed on Files.
 - e. Explain the Unix V 7 File system.
 - f. List and explain any five operations performed on Directories.

3. **Attempt any three of the following:** 15
 - a. What are block devices and character devices? Explain.
 - b. Write a short note on Memory Mapped IO.
 - c. Explain Direct Memory Access using suitable diagram.
 - d. Explain preemptable and non-preemptable resources.
 - e. List Coffman's four conditions that must hold for a resource to be in deadlock.
 - f. Explain the process of Deadlock Detection with One Resource of Each Type.

4. **Attempt any three of the following:** 15
 - A. Write a note on Type-1 and Type-2 Hypervisor.
 - B. Explain any five advantages of virtualization.
 - C. List and explain five essential characteristics of Cloud.
 - D. Write a note on Virtual Machine Migration.
 - E. What is Master-Slave Multiprocessors Operating System?
 - F. List the different Multicomputer Interconnection Technologies. Explain any two.

5. **Attempt any three of the following:** 15
 - a. Explain the kernel structure of Linux.
 - b. List and explain any five file-system related system calls in Linux.
 - c. Using suitable diagram explain the architecture of Android Operating System.
 - d. Explain the programming layers in modern windows operating System.
 - e. Explain the booting process of windows OS.
 - f. Write a note on windows power management.

(2½ Hours)

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1. Attempt any three of the following: 15

- a. Convert the following.
 (i) $(1051.36)_{10} = (?)_8$
 (ii) $(F9A.D5)_{16} = (?)_{10}$
- b. What is Hamming code? A seven bit even parity hamming code is received as 1110101. What is the correct code?
- c. Certain number system has base 7. What is the hexadecimal equivalent of the minimum and maximum number that is expressed using the base 7 and four bits?
- d. Solve the following.
 (i) $(111000.01)_2 - (100111.00)_2$
 (ii) $(1010101)_2 \div (11)_2$
- e. Perform the following.
 (i) $(727)_8 + (234)_8$
 (ii) $(2C48)_{16} - (9AA)_{16}$ using 1C method
- f. Solve the following.
 (i) Convert the following number to BCD and add them $(11)_{10} + (9)_{10}$
 (ii) Convert the following number to XS-3 and subtract them $(53)_{10} - (28)_{10}$

2. Attempt any three of the following: 15

- a. Reduce the following using Boolean laws and theorems.
 (i) $W\bar{X}(W + Y) + WY(\bar{W} + \bar{X})$
 (ii) $XY + \bar{X}\bar{Y}Z + (\bar{X}\bar{Y} + Z)$
- b. Write short notes on input bubbled AND gate and input bubbled OR gate.
- c. Prove the following.
 (i) $\bar{A}BC + A\bar{B}C + AB\bar{C} + ABC = AB + AC + BC$
 (ii) $(A + \bar{A}B)(C + \bar{D}) = \bar{A}\bar{B} + \bar{C}D$
- d. Simplify using K-map and realize it using minimum number of gates.
 $F(A,B,C,D,E) = \sum m(0,2,5,7,13,15,18,20,21,23,28,29,31)$
- e. Simplify using K-map and realize it using minimum number of gates.
 $F(A,B,C,D) = \prod M(4,6,8,9,10,12,13,14) + d(0,2,5)$
- f. Minimize expression using Quine Mc Cluskey method.
 $f(W,X,Y,Z) = \sum m(2,6,8,9,10,11,14,15)$

3. Attempt any three of the following: 15

- a. The input to a combinational logic circuit is a 4-bit binary number. Design the logic circuit with minimum hardware for the following
 (i) Output Y1 = 1 if the input binary number is 5 or less than 5.
 (ii) Output Y2 = 0 if the input binary number is 9 or more than 9.
- b. Convert 4 bit gray to 4 bit binary. Draw the truth table, necessary k-maps and logic circuit.

- c. Draw circuit and explain working of XS-3 adder.
- d. Design the Full Subtractor using K-map. Draw the circuit diagram for the same.
- e. How Booths algorithm speeds up the multiplication process? Explain with an example.
- f. Design single bit magnitude comparator. Draw truth table, K-map and circuit diagram for the same.

4. Attempt any three of the following:

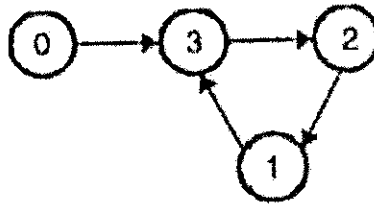
15

- a. Implement full adder circuit using 8:1 MUX.
- b. Cascade Demultiplexer. Build 1:8 demux using 1:4 demux chips.
- c. $Y = A + B + \bar{C}$. Realize using a multiplexer.
- d. Draw logic circuit diagram of D flip flop and describe with a truth table the working of it.
- e. How SR flip-flop can be used to work as T flip-flop? Explain.
- f. How flip-flop is used in eliminating keyboard debouncing? Explain.

5. Attempt any three of the following:

15

- a. Design modulo 6 ripple counter.
- b. Design 4 bit binary up/down counter with control input of up/down.
- c. Implement synchronous counter using JK FF for state diagram shown in figure.



- d. Write a short note on buffer register.
- e. Explain working of SIPO register.
- f. Write a short note on Johnson counter.

TYBSc (3F)

(2½ Hours)

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1. Attempt any three of the following:

- a. Define Universal Existential Statement and Existential Universal Statement. Give examples of each. 15
- b. Define Cartesian product. Let R denote the set of all real numbers. Describe $R \times R$.
- c. Find the number of integers between 1 and 250 that are divisible by 2 or 3 or 5 or 7.
- d. Prove that $(A \cup B) \cap (A \cap B)' = (A - B) \cup (B - A)$
- e. Write the negation of each of the following statements as simply as possible:
 i. If she works, she will earn money.
 ii. He swims if and only if the water is warm.
 iii. If it snows, then they do not drive the car.
 iv. John is 6 feet tall and he weighs at least 120 Kg.
 v. The train was late or Amol's watch was slow.
- f. Define the following:
 i. Argument, Premises
 ii. Syllogism
 iii. Explain Modus Ponens and Modus Tollens with examples.

2. Attempt any three of the following:

- a. Let 15
 $Q(n)$ be " n is a factor of 8,"
 $R(n)$ be " n is a factor of 4,"
 $S(n)$ be " $n < 5$ and $n \neq 3$,"
 and suppose the domain of n is \mathbb{Z}^+ , the set of positive integers. Use the \Rightarrow and \Leftrightarrow symbols to indicate true relationships among $Q(n)$, $R(n)$, and $S(n)$.
- b. Define necessary and sufficient conditions and only if as applied to universal conditional statements. Rewrite the following statements as formal and informal quantified conditional statements. Do not use the word necessary or sufficient.
 i. Squareness is a sufficient condition for rectangularity.
 ii. Being at least 35 years old is a necessary condition for being President of the United States.
- c. A college cafeteria line has four stations: salads, main courses, desserts, and beverages. The salad station offers a choice of green salad or fruit salad; the main course station offers spaghetti or fish; the dessert station offers pie or cake; and the beverage station offers milk, soda, or coffee. Three students, Uta, Tim, and Yuen, go through the line and make the following choices:
 Uta: green salad, spaghetti, pie, milk
 Tim: fruit salad, fish, pie, cake, milk, coffee
 Yuen: spaghetti, fish, pie, soda

Write each of following statements informally and find its truth value.

- i. \exists an item I such that \forall students S , S chose I .
 - ii. \exists a student S such that \forall items I , S chose I .
 - iii. \exists a student S such that \forall stations Z , \exists an item I in Z such that S chose I .
 - iv. \forall students S and \forall stations Z , \exists an item I in Z such that S chose I .
- d. Define a prime number and composite number. Give symbolic definitions of the same. Disprove the following by giving two counter examples:
- i. For all real numbers a and b , if $a < b$ then $a^2 < b^2$.
 - ii. For all integers n , if n is odd then $(n - 1)/2$ is odd.
 - iii. For all integers m and n , if $2m + n$ is odd then m and n are both odd.
- e. Define divisibility. Hence prove that for all integers a , b , and c , if $a \mid b$ and $a \mid c$ then $a \mid (b + c)$ and $a \mid (b - c)$.
- f. Use the quotient-remainder theorem with $d = 3$ to prove that the product of any three consecutive integers is divisible by 3. Use the mod notation to rewrite the result

3. Attempt **any three** of the following:

15

- a. i. Write the following as a single summation:

$$3 \sum_{k=1}^n (2k - 3) + \sum_{k=1}^n (4 - 5k)$$

- ii. Write the following as a single product:

$$\left(\prod_{k=1}^n \frac{k}{k+1} \right) \cdot \left(\prod_{k=1}^n \frac{k+1}{k+2} \right)$$

- iii. Find $1(1!) + 2(2!) + 3(3!) + \dots + m(m!); m = 2$

- iv. Find

$$\left(\frac{1}{1+1} \right) \left(\frac{2}{2+1} \right) \left(\frac{3}{3+1} \right) \dots \left(\frac{k}{k+1} \right); k = 3$$

- v. Prove that for all nonnegative integers n and r with $r + 1 \leq n$,

$$\binom{n}{r+1} = \frac{n-r}{r+1} \binom{n}{r}$$

- b. Prove that $7^{2n} + (2^{3n-3})(3^{n-1})$ is divisible by 25 $\forall n \in \mathbb{N}$

- c. Determine the sequence whose recurrence relation is $a_n = 4a_{n-1} + 5a_{n-2}$ with $a_1 = 2$ and $a_2 = 6$

- d. i. Define $G: J_5 \times J_5 \rightarrow J_5 \times J_5$ as follows: For all $(a, b) \in J_5 \times J_5$,

$$G(a, b) = ((2a + 1) \bmod 5, (3b - 2) \bmod 5)$$

Find: $G(4, 4)$, $G(2, 1)$, $G(3, 2)$, $G(1, 5)$

- ii. Let F and G be functions from the set of all real numbers to itself. Define the

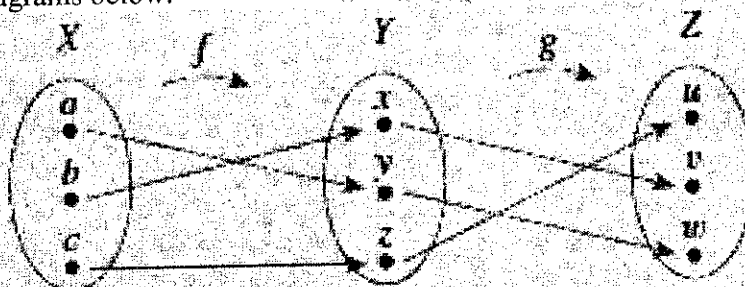
product functions $F \cdot G: \mathbb{R} \rightarrow \mathbb{R}$ and $G \cdot F: \mathbb{R} \rightarrow \mathbb{R}$ as follows: For all $x \in \mathbb{R}$,

$$(F \cdot G)(x) = F(x) \cdot G(x)$$

$$(G \cdot F)(x) = G(x) \cdot F(x)$$

Does $F \cdot G = G \cdot F$? Explain.

- e. i. Define Floor: $\mathbf{R} \rightarrow \mathbf{Z}$ by the formula $Floor(x) = \lfloor x \rfloor$, for all real numbers x .
- Is Floor one-to-one? Prove or give a counterexample.
 - Is Floor onto? Prove or give a counterexample.
- ii. Let S be the set of all strings of 0's and 1's, and define
- $l: S \rightarrow \mathbf{Z}^{nonneg}$ by
- $l(s) =$ the length of s , for all strings s in S .
- Is l one-to-one? Prove or give a counterexample.
 - Is l onto? Prove or give a counterexample.
- f. Let $X = \{a, c, b\}$, $Y = \{x, y, z\}$, and $Z = \{u, v, w\}$. Define $f: X \rightarrow Y$ and $g: Y \rightarrow Z$ by the arrow diagrams below.



Find: $g \circ f, (g \circ f)^{-1}, f^{-1}, g^{-1}, f^{-1} \circ g^{-1}$.
How $(g \circ f)^{-1}$ and $f^{-1} \circ g^{-1}$ are related?

4. Attempt any three of the following:

a Draw the directed graph for the following relations:

- i. A relation R on $A = \{0, 1, 2, 3\}$ by $R = \{(0, 0), (1, 2), (2, 2)\}$.
- ii. Let $A = \{2, 3, 4, 5, 6, 7, 8\}$ and define a relation R on A as follows:

For all $x, y \in A, x R y \Leftrightarrow x | y$.

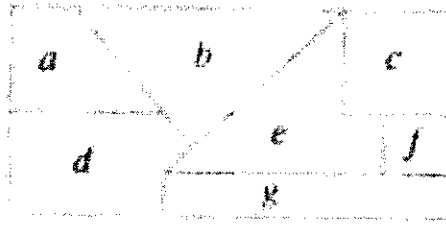
b Determine whether the following relations are reflexive, symmetric, transitive or none of these. Justify your answer.

- i. R is the "greater than or equal to" relation on the set of real numbers:
For all $x, y \in \mathbf{R}, x R y \Leftrightarrow x \geq y$.
- ii. D is the relation defined on \mathbf{R} as follows:
For all $x, y \in \mathbf{R}, x D y \Leftrightarrow xy \geq 0$.

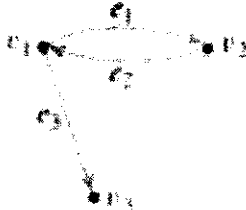
c Let \mathbf{R} be the set of all real numbers and define a relation R on $\mathbf{R} \times \mathbf{R}$ as follows: For all (a, b) and (c, d) in $\mathbf{R} \times \mathbf{R}, (a, b) R (c, d) \Leftrightarrow$ either $a < c$ or both $a = c$ and $b \leq d$.

Is R a partial order relation? Prove or give a counterexample.

d Imagine that the diagram shown below is a map with countries labeled a-g. Is it possible to color the map with only three colors so that no two adjacent countries have the same color? To answer this question, draw and analyze a graph in which each country is represented by a vertex and two vertices are connected by an edge if, and only if, the countries share a common border.



- e. i. Find the adjacency matrix of the following graph:



- ii. Find directed graphs that have the following adjacency matrix:

$$\begin{bmatrix} 1 & 0 & 1 & 2 \\ 0 & 0 & 1 & 0 \\ 0 & 2 & 1 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$$

- f. For the following either draw the graph as per the specifications or explain why no such graph exists:

- i. Graph, circuit-free, nine vertices, six edges
- ii. Tree, six vertices, total degree 14
- iii. Tree, five vertices, total degree 8
- iv. Graph, connected, six vertices, five edges, has a nontrivial circuit
- v. Graph, two vertices, one edge, not a tree

5. Attempt any three of the following:

15

- a. There are four bus lines between A and B and three bus lines between B and C. In how many ways can a man travel
 - i. by bus from A to C by way of B?
 - ii. round-trip by bus from A to C by way of B?
 - iii. round-trip by bus from A to C by way of B if he does not want to use a bus line more than once?
- b.
 - i. How many ways can the letters of the word ALGORITHM be arranged in a row?
 - ii. How many ways can the letters of the word ALGORITHM be arranged in a row if A and L must remain together (in order) as a unit?
 - iii. How many ways can three of the letters of the word ALGORITHM be selected and written in a row?
 - iv. How many ways can six of the letters of the word ALGORITHM be selected and written in a row if the first letter must be A?
 - v. How many ways can the letters of the word ALGORITHM be arranged in a row if the letters GOR must remain together (in order) as a unit?

- c.
- i. If 4 cards are selected from a standard 52-card deck, must at least 2 be of the same suit? Why?
 - ii. If 5 cards are selected from a standard 52-card deck, must at least 2 be of the same suit? Why?
 - iii. A small town has only 500 residents. Must there be 2 residents who have the same birthday? Why?
 - iv. Given any set of four integers, must there be two that have the same remainder when divided by 3? Why?
 - v. Given any set of three integers, must there be two that have the same remainder when divided by 3? Why?
- d.
- i. How many distinguishable ways can the letters of the word *HULLABALOO* be arranged in order?
 - ii. How many distinguishable orderings of the letters of *HULLABALOO* begin with U and end with L?
 - iii. How many distinguishable orderings of the letters of *HULLABALOO* contain the two letters HU next to each other in order?
- e. A bakery produces six different kinds of pastry, one of which is eclairs. Assume there are at least 20 pastries of each kind.
- i. How many different selections of twenty pastries are there?
 - ii. How many different selections of twenty pastries are there if at least three must be eclairs?
 - iii. How many different selections of twenty pastries contain at most two eclairs?
- f. A drug-screening test is used in a large population of people of whom 4% actually use drugs. Suppose that the false positive rate is 3% and the false negative rate is 2%. Thus a person who uses drugs tests positive for them 98% of the time, and a person who does not use drugs tests negative for them 97% of the time.
- i. What is the probability that a randomly chosen person who tests positive for drugs actually uses drugs?
 - ii. What is the probability that a randomly chosen person who tests negative for drugs does not use drugs?
-



(2½ Hours)

[Total Marks: 75]

- N. B.: (1) **All** questions are **compulsory**.
(2) Make **suitable assumptions** wherever necessary and **state the assumptions** made.
(3) Answers to the **same question** must be **written together**.
(4) Numbers to the **right** indicate **marks**.
(5) Draw **neat labeled diagrams** wherever **necessary**.
(6) Use of **Non-programmable** calculators is **allowed**.

1. **Attempt any three of the following:** 15
a. Discuss the seven Cs of effective communication.
b. What is conferencing? Explain different types of conferencing.
c. Explain the stages in developing relationships through interpersonal communication.
d. Discuss Dysfluency and Tempo/Pacing, the sub-categories of paralanguage.
e. What is the role of proxemics in non-verbal communication? Explain.
f. Distinguish between the attributes of high context and low context cultures.
2. **Attempt any three of the following:** 15
a. Explain the five main stages of writing business messages.
b. Discuss the different strategies for writing the body of a business letter.
c. What are different types of audience? Discuss the factors required for audience analysis.
d. State and explain the steps in writing a routine business report.
e. List and explain the ten resume mistakes that must be avoided.
f. Explain the different barriers that create listening barriers.
3. **Attempt any three of the following:** 15
a. What are the purposes of a conference? Explain the different points to be considered for effectively conducting a conference.
b. Enumerate the different steps involved in a Group Discussion. Discuss the critical success factors in a group discussion.
c. What is team briefing? How can it be made effective?
d. What is marketing communication? How does it work?
e. State and explain the activities involved in branding a project.
f. What is financial communication? What are its constituents? Explain.
4. **Attempt any three of the following:** 15
a. What is corporate citizenship and social responsibility? How does CSR fit with PR?
b. How can advertisements be planned for better results?
c. What are different approaches to effective negotiation? Explain the six steps of negotiations.
d. Explain the different ethical perspectives in communication.
e. Explain the rules of grammar that would be helpful in business communication.
f. Explain the functions performed by comma.
5. **Attempt any three of the following:** 15
a. What is mind-map? How is it useful in presentations? Explain. What should be included in the conclusion of a presentation?
b. How can presentations be made more effective?
c. Discuss the success factors in business presentation.
d. What are the different type of graphics used in presentations? Explain.
Why use of font, colour and layout is important in the impress stage of presentation?
Explain concept map with an example.

5782

f. g.



[Time: 2½ Hours]

[Total Marks:75]

Please check whether you have got the right question paper.

- N.B:
1. All questions are compulsory.
 2. Make suitable assumptions wherever necessary and state the assumptions made.
 3. Answers to the same question must be written together.
 4. Numbers to the right indicate marks.
 5. Draw neat labeled diagrams wherever necessary.
 6. Use of Non-programmable calculators is allowed.

Q.1 Attempt any three of the following:

(15)

- a. List various techniques for the development of a program? Explain any one with suitable example.
- b. What is program development life cycle? Explain its various stages.
- c. Discuss desirable program characteristics.
- d. Define keywords and identifiers in C language? Also differentiate between keywords and identifiers.
- e. What is constant? List various constants in C. Explain any two in detail with suitable examples.
- f. Assume that your version of C can recognize only first eight characters of an identifier name, though identifier names may be arbitrarily long. Which of the following pairs of identifier names are considered to be identical and which are distinct?
(i) Address , address (ii) name, names (iii) list1, list2 (iv) answer, ANSWER (v) identifier_1, identifier_2

Q.2 Attempt any three of the following:

(15)

- a. What do you understand from hierarchy/precedence of operators?
What is the hierarchy of operators in c?
- b. Explain the purpose and use of following operators with suitable examples
(i) == and =
(ii) Conditional operator (?:)
- c. C program contains the following declarations and initial assignments
int i=8, j=5;
float x=0.005, y=-0.001;
Determine the value of each of the following expressions
(i) $2*(i/5)+(4*(j-3))\%(i+j-2)$
(ii) $(x>y)\&\&(i>0)\|\!(j<5)$
- d. Summarize the meaning of commonly used conversion characters within the control string of a scanf() function.
- e. C program contains the following variable declarations
float a=2.5, b=0.0005, c=3000.0;
Show the output from following printf statements
(i) `printf("%f %f %f", a,b,c);`
(ii) `printf("%3f %3f %3f", a,b,c);`
(iii) `printf("%8f %8f %8f", a,b,c);`
(iv) `printf("8.4f f %8.4f %8.4f", a,b,c);`
(v) `printf("%e %e %e", a,b,c);`

[TURN OVER]

- f. Write an interactive C program to find roots of a quadratic equation $ax^2+bx+c=0$ and roots are given by $-b \pm \sqrt{(b^2-4c)}/2a$.

Q.3 Attempt any three of the following:

(15)

- a. What are control statements? Explain any two of them.
 b. Differentiate between while and do while loop with suitable examples. When to use which Loop?
 c. How many times following loops will be executed in the following code

```
(i) for(i=10;i<25;i++)
{.....
.....
}
```

```
(ii) int i=0,n=10,sum=0;
while (i<=n)
{
sum+=i;
}
```

```
(iii) for(i=0,j=10;i<10;i++j--)
{.....
.....}
```

```
(iv) for(i=100;i>70;i=i-2)
{.....
.....}
```

```
(v) int i=1,n=5
while(i<=10)
{.....
if(i==n)
break;
i++;
}
```

- d. Predict the output of following C codes

```
(i)int i;
for(i=0;i<=2;i++)
{
switch(i)
{
case 1 : printf("%d",i);
case 2 : printf("%d",i);
default : printf("%d",i);
}
}
```

[TURN OVER]

Q.P. Code : 00896

```

(ii)Void exchange (int,int);
void main( )
{
    int x=20,y=10;
        exchange(x,y);
        printf("%d, %d",y,x);
    }
Void exchange(int x, int y)
{
    int temp;
    temp=x;
        x=y;
    y=temp;
}

```

- e. What is a function? Explain the purpose of function prototype, function call and function definition in a C program.
- f. What is recursion? Write a recursive function to calculate factorial of a number.

Q.4 Attempt any three of the following:

(15)

- What do you understand from storage classes? List various storage classes? Explain any two.
- What is the purpose of a static function in a multifile program? Explain with suitable example.
- What are preprocessors in C language? Explain #if-#else-#endif preprocessor directive with suitable example.
- What is macro? Summarize the similarities and differences between macros and functions.
- What is an array? What are advantages of using arrays? Discuss one dimensional array.
- Write a C program to find largest number out of given n numbers stored in an array using a function.

Q.5 Attempt any three of the following:

(15)

- a. C program contains following statements

```

int i,j=25;
int *pi,*pj=&j;
*pj=j+5;
i=*pj+5;
pi=pj;
*pi=i+j;

```

Suppose each integer quantity occupies 2 bytes of memory. If the value assigned to i begins at address 1456 and value assigned to j begins at 1458 then

- What value is represented by &i and &j?
 - What value is represented by pj and *pj?
 - What value is assigned to i?
 - What is the value represented by pi?
 - What value is represented by (pi+2)?
- b. What is dynamic memory allocation? Explain the use of malloc function with example.
- c. Write a C program to perform addition and subtraction of two pointer variable.

[TURN OVER]

- d. What is a structure? How does a structure differ from an array?
- e. What is a union? Differentiate between structure and union.
- f. (a) Define a structure of type hms containing
Three integer members, called hours, minutes and second, respectively.
Then define a union containing two members, each a structure of type hms.
Call the union members local and home respectively.
Declare a pointer variable called time that points to this union.
- (b) Define a union of type ans which contains
an integer quantity called ians,
a floating point quantity called fans,
a double precision quantity called dans.
Then define a structure with members
a union of type ans called answer,
a single character called flag,
integer quantities called A and B.
Finally declare two structure variables called x and Y.

[Time: $2\frac{1}{2}$ Hours]

[Marks:75]

Please check whether you have got the right question paper.

- N.B:
1. All questions are compulsory.
 2. Make suitable assumptions wherever necessary and state the assumptions made.
 3. Answer to the same question must be written together.
 4. Numbers to the right indicate marks.
 5. Draw neat labeled diagrams wherever necessary.
 6. Use of Non-programmable calculators is allowed.

1. **Attempt any three of the following:** (15)
 - a. Write the difference between analog signal and digital signal.
 - b. Convert the following numbers
 $(17E.F6)_{16} = (?)_2$
 $(110010100011.10100101)_2 = (?)_2$
 - c. Convert the given
 $(125.50)_{10} = (?)_2$
 $(110001)_2 = (?)_{10}$
 - d. Find
 - i) The Gray code equivalent of Decimal (13)
 - ii) Binary equivalent of Gray code 1111.
 - iii) Hexadecimal equivalent of octal (765)
 - iv) Octal equivalent of binary(1100111110101)
 - v) Decimal equivalent of binary 1010101010.
 - e. Write a short note on Error correction and detection code.
 - f. i) Perform the addition of following Binary number
 $(1100010 + 1010001)$
 ii) Perform the Subtraction of following Binary numbers using 1's complement method.
 $(11011 - 10001)$.
2. **Attempt any three of the following:** (15)
 - a. For the logic expression $Y=AB+A'B'$ Obtain the truth table, name the operation performed, realize the operation using AND, OR, NOT gate.
Also realize it using NAND gate only.
 - b. Draw the output wave form of AND gate and explain it's operation. Also, discuss about 4 input AND gate.
 - c. Prove the following using Boolean law
 $A+A'.B + A.B' = A+B$
 - d. Reduce the given SOP equation using K-map method and draw the circuit using NAND network.
 $ABC + ABC' + AB'C' + A'BC$.
 - e. Reduce the given POS function using K-map and draw the circuit diagram using NOR network
 $F(A,B,C,D) = \prod(0,1,2,3,7,8,9,10,11)$
 - f. Using Don't care condition find reduced SOP equation and draw the circuit diagram using basic gates
 $F(P,Q,R,S) = \sum(1,2,3,6,12,14) + d(0,11,13)$

[TURN OVER]

3. **Attempt any three of the following:** (15)
- Design the Half adder using K-map. Draw the circuit diagram for the same.
 - With the help of circuit diagram discuss four bit binary adder-subtractor.
 - Design two bit magnitude comparator.
 - Write a short note on BCD to EXCESS-3 code converter.
 - What is Multiplier? Draw diagram and explain 4x4 bit multiplier.
 - Explain Full Adder in detail.

4. **Attempt any three of the following:** (15)
- Draw the logic diagram of 4 to 1 multiplexer. Explain its working.
 - Write a short note on demultiplexer.
 - Define cascading. Design 16 to 1 multiplexer using 8 to 1 multiplexer.
 - With the help of diagram explain Bistable Multivibrator.
 - What is meant by race around problem? Explain master slave flip-flop.
 - How J-K flip-flop can be used to form a D flip-flop.

5. **Attempt any three of the following:** (15)
- Write a short note on modulus of counter.
 - Explain the working of four bit UP/DOWN counter.
 - Determine the number of flip-flops in Mod 10 ring counter and Johnson counter. Write count sequence in both the cases.
 - Briefly describe the architecture of SISO shift register.
 - Explain the design procedure for MOD 8 binary counter.
 - The table gives below the excitation of flip-flop having inputs X1 and X2. Draw the circuit excitation table of Mod -5 synchronous counter using this flip-flop for the counter sequence 000,001,010,011,100,000. Design the counter using flip-flop whose excitation table is given below.

Preset state (Q _n)	Next state (Q _{n+1})	Input (X1)	Input (X2)
0	0	0	0
0	1	0	1
1	0	1	X
1	1	X	

Please check whether you have got the right question paper.

- N.B:
1. **All** questions are **compulsory**.
 2. **Make suitable assumptions** wherever necessary and **state the assumptions** made.
 3. Answers to the **same question** must be **written together**.
 4. Numbers to the **right** indicate **marks**.
 5. Draw **neat labeled diagrams** wherever **necessary**.
 6. Use of **Non-programmable** calculators is **allowed**.

1. Attempt **any three** of the following: 15
 - a. Define Operating System. Explain the role of OS as extended machine.
 - b. Write a short note on fifth generation Operating System.
 - c. Explain the micro kernel approach of Operating System design.
 - d. List and explain any five system calls used in process management.
 - e. Explain process states and possible transitions among these states using diagram.
 - f. List the three categories and goals of scheduling algorithms.

2. Attempt **any three** of the following: 15
 - a. Explain the concept of running multiple programs without memory abstraction.
 - b. Write a note on swapping.
 - c. Explain page table and Structure of a Page Table Entry using suitable diagram.
 - d. Write a short note on Single-Level & Hierarchical Directory Systems.
 - e. Define file. Explain any four operations associated with file.
 - f. Explain disk quotas.

3. Attempt **any three** of the following: 15
 - a. Write a note on device controller.
 - b. Explain RAID in details with its different levels (any four).
 - c. Write a short note on Touch Screen.
 - d. What are Preemptable and Non-preemptable Resources? Explain.
 - e. Define Deadlock. List the four conditions that must hold for there to be a deadlock.
 - f. Explain recovery from deadlock through preemption and rollback.

4. Attempt **any three** of the following: 15
 - a. Explain type- 1 and type -2 hypervisor using suitable diagram.
 - b. Write a note on clouds.
 - c. What are the requirements of virtualization?
 - d. Write a note on I/O virtualization.
 - e. Explain using suitable diagram multicomputer hardware interconnection technology.
 - f. Write any five comparisons between multiprocessor and distributed system.

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5. Attempt **any three** of the following:

15

- a. Explain using suitable diagram the kernel structure of Linux operating system.
 - b. Explain the booting of Linux operating system.
 - c. List and explain the design goals of android operating system.
 - d. List Win 32 calls for managing processes and threads.
 - e. Explain using suitable diagram NTFS master file table and its attribute.
 - f. Briefly explain windows power management.
-

TURN OVER



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D. Maths

Q.P. Code :00901

[Time: $2\frac{1}{2}$ Hours]

[Marks:75]

Please check whether you have got the right question paper.

- N.B:
1. All questions are compulsory.
 2. Make suitable assumptions wherever necessary and state the assumptions made.
 3. Answers to the same question must be written together.
 4. Numbers to the right indicate marks.
 5. Draw neat labeled diagrams wherever necessary.
 6. Use of Non-programmable calculators is allowed.

Q1 Attempt any three of the following:

15

- a) i. Which of the following sets are equal? Justify your answer:

$$A = \{0, 1, 2\}$$

$$B = \{x \in \mathbb{R} \mid -1 \leq x < 3\}$$

$$C = \{x \in \mathbb{R} \mid -1 < x < 3\}$$

$$D = \{x \in \mathbb{Z} \mid -1 < x < 3\}$$

$$E = \{x \in \mathbb{Z}^+ \mid -1 < x < 3\}$$

- ii. Let $A = \{w, x, y, z\}$ and $B = \{a, b\}$. Use the set-roster notation to write each of the following sets, and indicate the number of elements that are in each set:

$$A \times B, T \times S, S \times S, T \times T$$

- b) A relation C from \mathbb{R} to \mathbb{R} is defined as follows: For any $(x, y) \in \mathbb{R} \times \mathbb{R}$.

$$(x, y) \in C \text{ means that } x^2 + y^2 = 1$$

- i. Does $(1, 0) \in C$? Does $(0, 0) \in C$? Is $-2 \in C$? Is $0 \in C$? Is $-1 \in C$?
- ii. What are the domain and co-domain of C ?
- iii. Draw a graph for C by plotting the points of C in the Cartesian plane.

- c) Let p be the statement "DATAENDFLAG is off," q the statement "ERROR equals 0," and r the statement "SUM is less than 1,000." Express the following sentences in symbolic notation.

- i. DATAENDFLAG is off, ERROR equals 0, and SUM is less than 1,000.
- ii. DATAENDFLAG is off but ERROR is not equal to 0.
- iii. DATAENDFLAG is off; however, ERROR is not 0 or SUM is greater than or equal to 1,000.
- iv. DATAENDFLAG is on and ERROR equals 0 but SUM is greater than or equal to 1,000.
- v. Either DATAENDFLAG is on or it is the case that both ERROR equals 0 and SUM is less than 1,000

- d) The logician Raymond Smullyan describes an island containing two types of people: knights who always tell the truth and knaves who always lie. You visit the island and are approached by two natives who speak to you as follows:

A says: B is a knight.

B says: A and I are of opposite type.

What are A and B? Explain with logical reasoning.

- e) Let sets R , S , and T be defined as follows:

$$R = \{x \in \mathbb{Z} \mid x \text{ is divisible by } 2\}$$

$$S = \{y \in \mathbb{Z} \mid y \text{ is divisible by } 3\}$$

$$T = \{z \in \mathbb{Z} \mid z \text{ is divisible by } 6\}$$

- i. Is $R \subseteq T$? Explain.
- ii. Is $T \subseteq R$? Explain.
- iii. Is $T \subseteq S$? Explain.

P.T.O.

- f. Given sets A and B , the symmetric difference of A and B , denoted $A \Delta B$, is

$$A \Delta B = (A - B) \cup (B - A).$$

Let $A = \{1, 2, 3, 4\}$, $B = \{3, 4, 5, 6\}$, and $C = \{5, 6, 7, 8\}$. Find each of the following sets:

- i. $A \Delta B$
- ii. $B \Delta C$
- iii. $A \Delta C$
- iv. $(A \Delta B) \Delta C$

Q 2 Attempt any three of the following:

15

- a. i. Give counter examples to prove that the following statements are false:

- a. $\forall x \in \mathbb{R}, x > 1/x$.
- b. $\forall a \in \mathbb{Z}, (a - 1)/a$ is not an integer.
- c. \forall positive integers m and n , $m \times n \geq m + n$.

- ii. Consider the following statement:

$$\exists x \in \mathbb{R} \text{ such that } x^2 = 2.$$

Which of the following are equivalent ways of expressing this statement?

- a. The square of each real number is 2.
- b. Some real numbers have square 2.
- c. The number x has square 2, for some real number x .
- d. If x is a real number, then $x^2 = 2$.
- e. There is at least one real number whose square is 2.

- b. Write negation for each of the following statements:

- i. \forall real numbers x , if $x^2 \geq 1$ then $x > 0$.
- ii. \forall integers d , if $6/d$ is an integer then $d = 3$.
- iii. $\forall x \in \mathbb{R}$, if $x(x + 1) > 0$ then $x > 0$ or $x < -1$.
- iv. $\forall n \in \mathbb{Z}$, if n is prime then n is odd or $n = 2$.
- v. \forall integers a , b and c , if $a - b$ is even and $b - c$ is even, then $a - c$ is even.

- c. i. Rewrite the following argument using quantifiers, variables, and predicate symbols. Is this argument valid? Why? Explain.

If an integer is even, then its square is even.

k is a particular integer that is even.

$\therefore k^2$ is even.

- ii. Prove the following by using universal modus ponens:

Suppose m and n are particular but arbitrarily chosen even integers. Then

$m = 2r$ for some integer r and $n = 2s$ for some integer s . Hence

$$m + n = 2r + 2s \quad \text{by substitution}$$

$$= 2(r + s) \quad \text{by factoring out the 2.}$$

Now $r + s$ is an integer, and so $2(r + s)$ is even. Thus $m + n$ is even.

- d. i. Is 1 prime? Why?
- ii. Is every integer greater than 1 either prime or composite? Prove.
- iii. Prove the following: \exists an even integer n that can be written in two ways as a sum of two prime numbers.
- iv. Suppose that r and s are integers. Prove the following: \exists an integer k such that $22r + 18s = 2k$.
- v. Disprove the following statement by finding a counterexample:

$$\forall \text{ real numbers } a \text{ and } b, \text{ if } a^2 = b^2 \text{ then } a = b.$$

P.T.O.

- e. Prove that for all real numbers x and for all integers m , $[x + m] = [x] + m$.

- f. By using negation, prove that $\sqrt{2}$ is irrational.

Q 3 Attempt any three of the following:

15

- a. Transform the following summation by making the specified change of variable.

$$\sum_{k=1}^{n+1} \frac{k}{n+k} \quad \text{change of variable: } j = k - 1$$

Transform the summation so obtained by changing all j 's to k 's.

- b. For all integers $n \geq 0$, $2^{2^n} - 1$ is divisible by 3.
- c. Suppose a sequence b_0, b_1, b_2, \dots satisfies the recurrence relation

$$b_k = 4b_{k-1} - 4b_{k-2} \text{ for all integers } k \geq 2,$$
 with initial conditions $b_0 = 1$ and $b_1 = 3$. Find an explicit formula for b_0, b_1, b_2, \dots .
- d. Define logarithm and logarithmic functions. Use the definition of logarithm to prove that for any positive real number b with $b \neq 1$, $\log_b b = 1$ and $\log_b 1 = 0$.
- e. A function F is defined as $F: \mathbf{R} \times \mathbf{R} \rightarrow \mathbf{R} \times \mathbf{R}$ as follows: For all $(x, y) \in \mathbf{R} \times \mathbf{R}$,

$$F(x, y) = (x + y, x - y).$$

Is F a one-to-one correspondence from $\mathbf{R} \times \mathbf{R}$ to itself?

- f. Define countably infinite, countable and uncountable sets. Show that the set \mathbf{Z} of all integers is countable.

Q 4 Attempt any three of the following:

15

- a. A relation R from \mathbf{R} to \mathbf{R} as follows: For all $(x, y) \in \mathbf{R} \times \mathbf{R}$,

$$x R y \Leftrightarrow y = 2|x|.$$

Draw the graphs of R and R^{-1} in the Cartesian plane. Is R^{-1} a function?

- b. A relation T on \mathbf{Z} (the set of all integers) is defined as follows: For all integers m and n ,

$$m T n \Leftrightarrow 3 \mid (m - n).$$

Is T reflexive? Is T symmetric? Is T transitive? Prove.

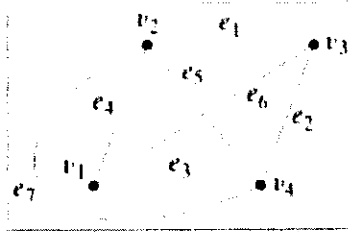
- c. If A is a set, R is an equivalence relation on A , and a and b are elements of A , then either $[a] \cap [b] = \emptyset$ or $[a] = [b]$.

- d. State and prove the handshake theorem.

- e. Show that the graph below does not have an Euler circuit.

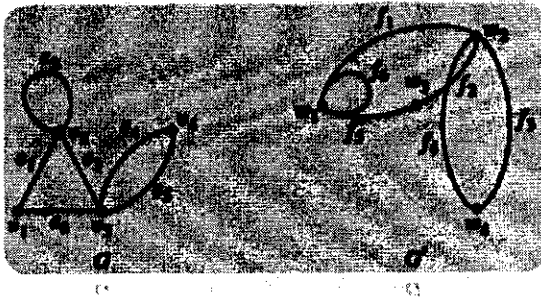
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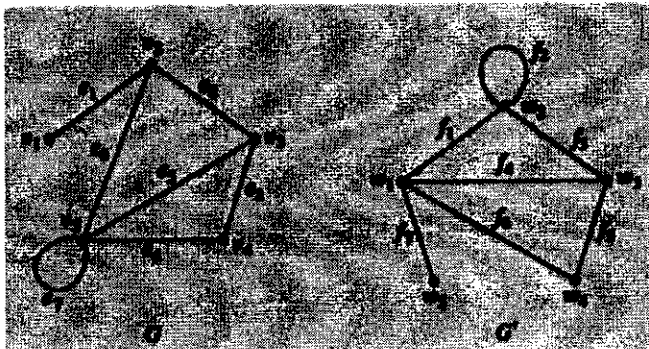


f. For each pair of graphs G and G' in, determine whether G and G' are isomorphic. If they are, give functions $g: V(G) \rightarrow V(G')$ and $h: E(G) \rightarrow E(G')$ that define the isomorphism. If they are not, give an invariant for graph isomorphism that they do not share.

i.



ii.



Please check whether you have got the right question paper.

- N.B:
1. All Questions are compulsory.
 2. Make suitable assumptions whenever necessary and state the assumption made.
 3. Answer to the same question must be written together.
 4. Numbers to the right indicate marks.
 5. Draw neat labeled diagrams whenever necessary.
 6. Use Non-programmable calculators is allowed.

Q.1 Attempt any three of the following.

15

- a. Explain the importance of completeness and correctness in effective communication.
- b. What are the different roles of Manager? Explain.
- c. What are the different forms of non-verbal communication? Explain with examples.
- d. Explain the different types of spontaneous gestures.
- e. Discuss the cross-cultural communication strategies.
- f. What are the different criteria for selection of appropriate technology for business communication? Explain.

Q.2 Attempt any three of the following.

15

- a. Discuss the factors to be considered at the planning stage of business writing.
- b. You are applying for admission to a management college. You are required to write a composition of about 300 words stating your objective in seeking the admission. Draft your objective.
- c. What is audience analysis? What is it critical? How can it be effectively used by an organization while issuing instructions?
- d. What is listening? What are its different types? Explain.
- e. "Language plays an important part in ineffective presentation". Agree or disagree? Justify your view.
- f. Explain the different non-verbal aspects in an interview.

Q.3 Attempt any three of the following.

15

- a. What is a conference? How it is planned and conducted? Explain.
- b. List and explain the different formats of group discussion.
- c. What is briefing? What are its different types? Explain each in brief.
- d. Discuss the preparatory steps involved in team presentations.
- e. Explain direct and indirect selling.
- f. Discuss the human resource communication in Indian industries.

Q.4 Attempt any three of the following.

15

- a. State and explain the different traits to be embedded into the corporate communication strategy.
- b. Explain intercultural negotiation with an example. What are the file inter-cultural negotiation skills?
- c. What are the basic principles of ethical communication followed by corporate houses?
- d. Discuss the AIDA model for advertising.
- e. How are effective paragraphs developed? Explain.
- f. What are the different referencing styles? Explain with examples.

Q.5 Attempt **any three** of the following.

15

- a. How is brainstorming done while planning the presentation? Explain.
 - b. What are the steps to be carried out during the "Plan" stage of the presentation? Explain.
 - c. Explain the "Execute" stage of presentation.
 - d. What are the different types of graphics used in presentation? Explain.
 - e. What should be done to make a presentation impressive? Explain.
 - f. Why should there be practice before presentation? Discuss.
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