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# 016301

**Mar. 2022**

**B.Tech. CE (DS) - III SEMESTER**

**Mathematics for Data Science (BSC-DS-301)**

Time : 90 Minutes]

[Max. Marks : 25

*Instructions :*

1. *It is compulsory to answer all the questions (1 mark each) of Part-A in short.*
2. *Answer any three questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

## PART-A

**1.** (a) Let $R = \{(1, 2), (2, 3), (3, 4), (2, 1)$ be a relation on a set $A = \{1, 2, 3, 4\}$. Find the transitive closure of $R$. (1)

(b) If $A = \{2, 3, 6, 12, 24, 36\}$ and $R$ is the relation such that $xRy$ if $x$ divides $y$, draw the Hasse diagram of $(A, R)$. (1)

(c) Explain complete graph with example. (1)

(d) State Euler's Theorem for a connected graph. (1)

(e) Describe normal group. (1)

(f) State Lagrange's theorem for a group. (1)

(g) State "Kleene Theorem". (1)

(h) Show that grammar $G$ with productions $S \to aS$, $S \to Sa$, $S \to a$ is ambiguous. (1)

(i) What is the difference of Bisection and Regula-Falsi method? (1)

(j) Using Simpson's rule, find $\int_0^1 \frac{dx}{x}$, (taking $n = 4$). (1)

## PART-B

2, (a) Let $f : R \to R$ and $g : R \to R$ be real valued functions defined by

$$f(x) = 2x^3 - 1,\ x \in R \text{ and } g(x) = \left[\frac{1}{2}(x+1)\right]^{1/3},\ x \in R.$$

Show that $f$ and $g$ are bijective and each is the inverse of each other. (3)

(b) Let A and B be two sets. If $A \subseteq B$, then $P(A) \subseteq P(B)$. (2)

3. If G is a connected planar graph with $e$ edges, $v$ vertices and $r$ regions, then $v - e + r = 2$. (5)



4. The product $HK$ of two subgroups $H$ and $K$ of a group $G$ is a subgroup of $G$ if and only if $HK = KH$. (5)

5. (a) Evaluate $(30)^{-1/5}$, by Newton's iteration method (correct to four decimal places). (3)

(b) Find a real root of the equation $x^3 - 2x - 5 = 0$, by the method of false position correct to three decimal places. (2)

6. (a) Find the language $L(G)$ generated by the grammar $G$ with variables $\sigma, A, B$; $T = \{a, b\}$ and productions $P = \{\sigma \to aB, B \to b, B \to bA, A \to aB\}$. (3)

(b) Show that language $L = \{a^m b^m : m$ is positive$\}$ is not regular. (2)