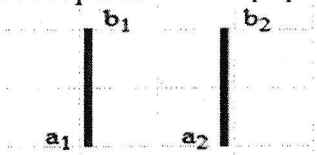
**K. J. Somaiya Institute of Technology, Sion, Mumbai-22**
**(Autonomous College Affiliated to University of Mumbai)**

Nov – Dec 2025
(B. Tech / ~~M. Tech.~~) Program: Artificial Intelligence & Data Science Scheme :-III
Regular Examination: SY Semester: III
Course Code: AIC305 and Course Name: Discrete structure for Data Science
Date of Exam: 04 /12/2025 Duration: 02.5 Hours Max. Marks: 60

Instructions:
(1)All questions are compulsory.
(2)Draw neat diagrams wherever applicable.
(3)Assume suitable data, if necessary.

| Q. No. | Question | Max. Marks | CO | BT level |
|---|---|---|---|---|
| Q 1 | Solve any **two** questions out of three: (05 marks each) | 10 | | |
| a) | Show that the following statement is tautological: $(p \wedge (p \rightarrow q)) \rightarrow q$ | | 1 | Ap |
| b) | Let S = { 1,2,3,4,5,6,7,8,9 }. Determine whether or not each of the following is a partition of S.<br>i) {{ 1,3,5}, {2,4,6,8 },{7,9}}<br>ii) {{S}} | | 2 | Ap |
| c) | If $L_1$ and $L_2$ are the lattices shown in below. Draw the Hasse diagram of $L_1 * L_2$ with the product partial order $a_1\ b_1$<br>  | | 3 | Ap |
| Q 2 | Solve any **two** questions out of three: (05 marks each) | 10 | | |
| a) | Apply the principle of inclusion and exclusion to determine how many integers between 1 and 2000 are divisible by 2, 3, 5, or 7? | | 4 | Ap |
| b) | Consider (2,6) the encoding function e: $B^2 \rightarrow B^6$ define as follows<br>e(00) = (000000) e(01) = (011110)<br>e(10) = (101010) e(11) = (111000)<br>How many error it can detect and correct. | | 5 | Ap |
| c) | 1) Is every Eulerian graphs a Hamiltonian?<br>2) Is every Hamiltonian graph an Eulerian?<br>Draw with necessary graph. | | 6 | Ap |
| Q.3 | Solve any **two** questions out of three. (10 marks each) | 20 | | |
| a) | Prove that $n! \geq 2^{n-1}$ for n = 1,2,....using Mathematical Induction. | | 1 | Ap |

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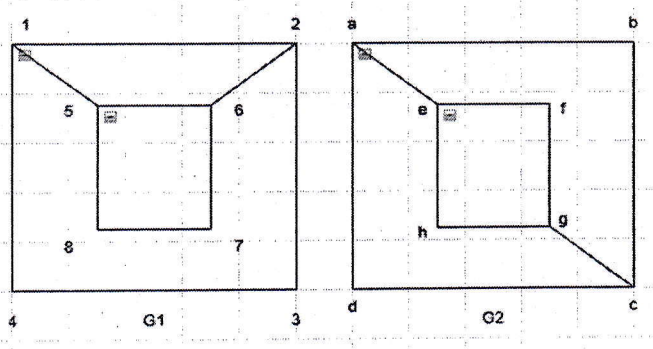
|---|---|---|---|---|
| b) | Find the solution Fibonacci relation $a_r = a_{r-1} + a_{r-2}$ with the initial condition is $a_0 = 0$, $a_1 = 1$. | | 4 | Ap |
| c) | Consider the $(2,5)$ encoding function: $e : B^3 \rightarrow B^5$ defined by $e(00) = 00000$ $e(01) = 01110$ $e(10) = 10101$ $e(11) = 11011$ Show that this encoding function is a group code. | | 5 | Ap |
| Q.4 | Solve any **two** questions out of three. (10 mark each). | 20 | | |
| a) | Let $A=\{11,12,13,14\}$, $R=\{(11,12),(12,13),(13,14),(12,11)\}$. Find out the transitive closure of R using Warshall's algorithm. | | 2 | Ap |
| b) | Draw the Hasse diagram of the Poset $A= (2, 3, 6, 12, 24, 36, 72)$ under the relation of divisibility in this Poset? Justify. | | 3 | Ap |
| c) | Show that following graph is isomorphic.   | | 6 | Ap |

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