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D1BAM2502

Name: .....

Reg. No.: .....

FIRST SEMESTER FYUGP EXAMINATION NOVEMBER 2025

(Regular/Improvement/Supplementary)

MINOR

AMA1MN104: MATHEMATICAL LOGIC, SET THEORY AND COMBINATORICS

Time: 2 Hrs. **Maximum Marks: 70**

M: Mark BL: Bloom's Taxonomy Level (1 to 6) CO: Course Outcome

Section A: Answer all questions. Each carries 3 marks.
Ceiling: 24 Marks

No.	Question	M	BL	CO
1.	Using De Morgan's laws, convert the following statement into an equivalent form: $\sim (P \vee (Q \wedge R))$	3	3	CO1
2.	Write the converse, inverse and contrapositive of the statement " If $\triangle ABC$ is equilateral, then it is isosceles".	3	6	CO1
3.	Determine the truth value of each proposition, where the UD = set of all real numbers: (1) $(\forall x)(x^2 \geq 0)$ (2) $(\forall x)(\|x\| > 0)$	3	2	CO1
4.	$Let P(x) : x^2 > x, Q(x) : x^2 = x$ and the UD = set of integers. Determine the truth value of each proposition. 1) (∃ x)[P(x) ∧ Q(x)] 2) (∀x)[P(x) ∨ Q(x)]	3	5	CO1
5.	Differentiate between symmetric difference and difference in set operations.	3	3	CO2
6.	Find the family of subsets of each set that do not contain consecutive integers. 1. {1, 2} 2. {1, 2, 3}	3	6	CO2
7.	Find |A| if |A| = |B| , |A ∪ B| = 2a + 3b, and |A ∩ B| = b.	3	2	CO2
8.	A student multiplied two matrices X = $\begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix}$ and Y = $\begin{bmatrix} 4 & 2 \\ 1 & 5 \end{bmatrix}$ and got the result $\begin{bmatrix} 9 & 7 \\ 3 & 15 \end{bmatrix}$. Analyze their work, find the mistake, and correct it. Explain the correct procedure	3	4	CO3
9.	$Let\ A = \begin{bmatrix} 2 & -3 & 1 \\ 4 & -1 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 2 \\ 1 & 0 \\ -1 & -2 \end{bmatrix}$ Find AB. Does BA exist? why? **(PTO)**	3	5	CO3

10.	Find the number of bytes with their second bit 0 or the third bit 1	3	1	CO3

Section B: Answer all questions. Each carries 6 marks.
Ceiling: 36 Marks

No.	Question	M	BL	CO
11.	Determine whether or not each is a tautology. 1) $p \vee (\sim p)$ 2) $[(p \rightarrow q) \wedge (\sim q)] \rightarrow \sim p$	6	1	CO1
12.	Check the validity of the following argument If Pat passes this course, she will graduate this year. Pat does not pass this course. _____ $\therefore$ Pat will not graduate this year.	6	6	CO1
13.	Examine the distributive property of set operations using the sets: A = {1, 2, 3, 6, 8, 9}, B = {2, 3, 4, 6, 8}, and C = {3, 4, 5, 6, 7, 10}.	6	4	CO2
14.	Let x = 3.456 and y = 2.789. Compute each. 1. $\lfloor x + y \rfloor$ 2. $\lfloor x \rfloor + \lfloor y \rfloor$ 3. $\lfloor xy \rfloor$ 4. $\lfloor x \rfloor \times \lfloor y \rfloor$ 5. $\lfloor -x \rfloor$ 6. $\lceil x + y \rceil$	6	2	CO3
15.	Compute the number of leap years after 1600 and not beyond each year. a) 2000 b) 2020 c) 3076 d) 4. 4050	6	5	CO3
16.	Find the number of positive integers ≤ 500 and divisible by: a) Two or three. b) Two or three, but not six. c) Two, three, or five. d) Neither two, three, nor five.	6	5	CO2 CO3
17.	Two fair six-sided dice are rolled. Apply probability concepts to answer the following. a) Calculate the probability of rolling a sum of 7. b) Calculate the probability of rolling a sum that is either 7 or 11. c) Calculate the probability of rolling two numbers that are both greater than 4.	6	3	CO3

18.	A game involves rolling two fair six-sided dice. A player wins if: a) The sum of the two dice is greater than 9. b) At least one of the dice shows a 4 Evaluate the probability of winning the game by calculating each condition, explaining how you account for any overlap between the two conditions.	6	5	CO3

Section C: Answer any one question. Each carries 10 marks. (1 x 10 = 10 Marks)

No.	Question	M	BL	CO
19.	According to a survey among 160 college students, 95 students take a course in English, 72 take a course in French, 67 take a course in German, 35 take a course in English and in French, 37 take a course in French and in German, 40 take a course in German and in English, and 25 take a course in all three languages. Find the number of students in the survey who take a course in: 1. English or French, but not German. 2. English and French, but not German. 3. English, but neither French nor German. 4. Neither English, French, nor German.	10	4	CO2
20.	A typical automobile license plate in New York contains three letters followed by three digits. Find the number of license plates of this kind that: 1. Can be formed. 2. Begin with a vowel. 3. Begin with the word BAT. 4. Begin with the digit 6. 5. Repeat no letters or digits. 6. Contain the same letters and the same digits. 7. Have the property that both words and numbers are palindromes.	10	2	CO3