

Course Code: OMC100C

Last Date of Submission: 31.12.2023

Course Title: Mathematical Foundation of Computer Science

Maximum Marks: 30

Assignment No.: 1

Session: July 2023

Note:

1. The assignment will have two parts, A and B. Part A is of 10 MCQ-type Questions of 1 mark each.

2. Part B is of 20 Marks having 8 Descriptive Questions. Attempt any 5 out of 8.

Part-A

(10x1=10 Marks)

Q.No	Question	CO
1	If $x$ is a set and the set contains an integer which is neither positive nor negative then the set $x$ is _____. a) Set is Empty    b) Set is Non-empty c) Set is Finite. <input checked="" type="checkbox"/> d) Set is both Non- empty and Finite. <span style="color: blue;">{0}</span>	CO1
2	If a relation $R$ has the property that for every $(a, b)$ in $R$ , $(b, a)$ is also in $R$ , what type of relation is $R$ ? a. Reflexive <input checked="" type="checkbox"/> b. Symmetric c. Transitive d. Antisymmetric	CO1
3	What is a partial order relation? a. Any relation with more than two elements b. A relation that is neither symmetric nor antisymmetric <input checked="" type="checkbox"/> c. A relation that is reflexive, antisymmetric, and transitive d. A relation with only one element	CO1
4	In the principle of mathematical induction, find which of the following steps is mandatory? <input checked="" type="checkbox"/> a) induction hypothesis                      b) inductive reference c) induction set assumption                  d) minimal set representation	CO1
5	According to principle of mathematical induction, if $P(k + 1) = m^{k+1} + 5$ is true then _____ must be true. a) $P(k) = 3m^k$ <input checked="" type="checkbox"/> b) $P(k) = m^k + 5$ c) $P(k) = m^{k+2}$ d) $P(k) = m^k$	CO1
6	If $\{1, 3, 5\}$ and $B = \{1, 3, 5, 7\}$ then $A$ is a .... subset of $B$ A) smaller <input checked="" type="checkbox"/> B) proper C) improper                      D) normal	CO1
7	A----- is a set $S$ with a relation $R$ on it which is reflexive, anti-symmetric, and transitive. A) equivalent set                  B) ordered set	CO1

	C) implicit set      ✓ D) Partially ordered set	
8	If every element in the domain is mapped to a unique element in the codomain, the function is said to be: ✓ a. One-to-one b. Onto c. Invertible d. Surjective	CO1
9	Which function is often used to round down a real number to the nearest integer? ✓ a. Floor function b. Ceiling function c. Ackermann's function d. Mod function	CO1
10	A function $f: A \rightarrow B$ is said to be ..... If for every $y$ in $B$ there exists at least one element $x$ in $A$ such that $f(x) = y$ . ✓ A) surjective      B) bijective C) injective      D) Automorphism	CO1

#### Part-B

(5x4=20 Marks)

Q.No	Question	CO
1	Determine whether the relation $R$ on the set of all Web pages is reflexive, symmetric, antisymmetric, and/or transitive, where $(a,b) \in R$ if and only if a) everyone who has visited Web page $a$ has also visited Web page $b$ . b) There are no common links found on both Web page $a$ and Web page $b$ . c) There is at least one common link on Web page $a$ and Web page $b$ . d) There is a Web page that includes links to both Web page $a$ and Web page $b$ .	CO 5
2	Given $f(x) = 2x$ and $g(x) = x^2$ , find the composition $g \circ f$ and evaluate it for $x = 3$ .	CO 3
3	Write set builder notation to give a description of each of these sets. a) $\{0,3,6,9,12\}$ b) $\{-3,-2,-1,0,1,2,3\}$ c) $\{m,n,o,p\}$	CO 1
4	Let $X = \{1, 2, 3, 4, 5\}$ and relation $R = \{(x, y)/x > y\}$ . Construct the graph of 'R' and also give its matrix.	CO 3
5	Use Mathematical Induction to show that $1^2 + 2^2 + \dots + 2^n = 2^{n+1} - 1$	CO 3
6	Write the Procedure for Euclidean algorithm to calculate gcd of two numbers.	CO 3
7	Verify by mathematical induction, $1^2 + 2^2 + \dots + n^2 = (n(n+1)(2n+1))/6$	CO 5

8	Use the Euclidean algorithm to Compute the greatest common divisor of 46 and 21.	CO 2
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$$1^2 + 2^2 + \dots + 2^n = 2^{(n+1)} - 1$$

$$n=1, \\ 1^2 + 2^{(1)} = 3, \quad 2^{(2)} - 1 = 3$$

$$n=2 \\ 1^{(2)} + 2^{(2)} + 2^{(2)} = 2^{(3)} - 1 \\ \quad \quad \quad \hookrightarrow 9 \quad \quad \quad \hookrightarrow 7$$