Marks scored:

KATHMANDU UNIVERSITY
End Semester Examination [C]
July, 2017

Level : B. E./ B. Sc.
Year : II

Course : MCSC 201
Semester : I

Exam Roll No. :
Registration No.:

Time: 30 mins.

F. M. : 20
Date : JUL 0 6 2017

SECTION "A"
[10 Q. × 1 = 10 marks]

Fill in the blank space(s) by writing most appropriate word(s) or symbols(s).

1. The contrapositive of the implication '$p \Rightarrow q$' is ....
2. The set $\{x : x \text{ is real and } x^2 = -1\}$ is ....
3. The symmetric closure of a relation R on a set B without closure property is ....
4. The range of floor function is ....
5. The expression $00^*(0 \vee 1)^*1$ over a set $A = \{0, 1\}$ is .... expression.
6. If the real valued function g is defined by $g(x) = x^3 - 1$, then $g^{-1}(26) =$ ....
7. The 4-base representation of 158 ....
8. Every subgroup of an abelian group is .... subgroup.
9. The quotient set of an equivalence relation R on the set of positive integers $A = \mathbb{Z}^+$ defined by $R = \{(a, b) \in A \times A : a \equiv b \pmod 3\}$, is ....
10. The product of an odd and an even permutation is ....

SECTION "B"
[10 Q. × 1 = 10 marks]

Fill in the blank space(s), DO NOT TICK, by choosing the most appropriate answer from among the given ones.

11. If a relation S on a set B is symmetric, then $\alpha = 0$, for all i, where α is
[m_{ii}; m_{ij}; m_{ji}; $-m_{jj}$]
12. Two elements a and b of a poset $(A, \leq)$ are comparable if ....
[$a \leq b$; $b \leq a$; $a \leq b$ or $b \leq a$; $a \leq b$ and $b \leq a$]

13. If two dices are tossed and the numbers on the top faces recorded then the probability that the sum of numbers being less than 5 is ....

[1/6; 2/6; 3/6; 5/6]

14. If A = {1, 2, 3, 4, 6}, R be a relation defined on A such that a R b iff a is a multiple of b. Then n(R) is ....

[10; 11; 12; 13]

15. If two real valued functions f and g are defined by $f(x) = x^2$ and $g(x) = x + 3$, then (g o f)(- 1) = ...

[-1; 2; 4 ; 6]

16. The sixth term of an infinite sequence defined by the recurrence relation $d_n = d_{n-1} + 4$ with $d_1 = 3$, is ....

[17; 19; 21; 23]

17. If f is the mod-12 function, then f(1259) + f(743) = ...

[22; 24; 26; 28]

18. The cardinality of the relation R defined on a set A = {1, 2, 3} by R = {(a, b): a + b ≤ 5} is ....

[6 ; 7 ; 8 ; 9]

19. If (T, v_0) is a rooted tree on a set A, then T is ....

[reflexive; symmetric; asymmetric ; antisymmetric]

20. Let f : S → T be a homomorphism of the semi group (S, ∗) onto the semi group (T, ∗') and R be the relation on S defined by a R b if, and only if f(a) = f(b), for all a, b in S, then T is isomorphic to ....

[S; R; R/ S; S/ R]

KATHMANDU UNIVERSITY
End Semester Examination [C]
July, 2017

JUL 06 2017

Level : B. E./ B. Sc.
Year : II
Time : 2 hrs. 30 mins.

Course : MCSC 201
Semester : I
F. M. : 55

SECTION "C"
[3 Q. × 7 = 21 marks]

1. Define a statement and describe logical quantifier(s) relative to predicate with examples. Also, for statements p, q, r, prove that $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$, where symbols have their usual meanings. [1+2+4]

2. What is meant by a relation? Define union, intersection and complement operations on relations from set A to set B. Also, for given two relations R and S from A to B, prove that (i) if R $\subseteq$ S, then $\overline{S} \subseteq \overline{R}$, and (ii) $\overline{R \cap S} = \overline{R} \cup \overline{S}$. [1+3+1+2]

OR

Define a composition of two relations on sets with example. If A, B, and C are three sets, R is a relation from A to B and S a relation from B to C, then show that $(S o R)^{-1} = R^{-1} o S^{-1}$. [2+1+4]

3. Define a group and a subgroup with examples. For given sets of even integers ***E*** and integers ***Z***, prove that (***E***, +) is a subgroup of (***Z***, +) where '+' is the usual addition in Z. [4+3]

SECTION "D"
[6 Q. × 4 = 24 marks]

4. Use Euclidean algorithm to find GCD(a, b) for a = 2345 and b = 2130 and then express it as sa + tb, for some integers s and t.

5. Let (G, $*$) and (G', $*$') be two groups, and let f: G $\rightarrow$ G' be a homomorphism from G to G'. Then, show that (i) If a $\in$ G, then $f(a^{-1}) = (f(a))^{-1}$, and (ii) If H is a subgroup of G, then the set $f(H) = \{f(h) | h \in H\}$ is a subgroup of G'.

OR

Prove that a complement in a bounded distributive lattice if it exists is unique.

6. For A = ***Z***, the set of integers, show that the relation R = {(a, b)$\in$ A×A: a $\equiv$ b(mod 5)} is an equivalence and then give the quotient set.

7. Define a Boolean matrix. Compute C ∨ D, C ∧ D and C ⊗ D, symbols have their usual meanings, for the given matrices, $C = \begin{bmatrix} 0 & 0 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$ and $D = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$. [1+3]

8. What is meant by a matrix associated with a relation defined on a finite set ? Find the transitive closure of the relation R = {(1, 1), (1, 4), (2, 2), (2, 3), (3, 2), (3, 3),(4, 1), (4, 4)} defined on a set A = {1, 2, 3, 4}, by using Warshal's algorithm. [1+3]

9. Find an explicit formula for the sequence defined by $c_n = 3\,c_{n-1} - 2\,c_{n-2}$ with initial conditions $c_1 = 5$ and $c_2 = 3$. Also, give the first four terms of the sequence. [3+1]

SECTION "E"

[5 Q. × 2 = 10 marks]

10. Show that if any five numbers from 1 to 8 are chosen, then two of them will add to 9.

11. Consider the set A = {t, u, v, w, x, y, z} and the relation R = {(t, u), (u, w), (u, x), (u, v), (v, z), (v, y)}. Determine if R is a tree, and if it is, find the root.

12. Draw the Hasse diagram of the lattice (P(A), ⊆), where P(A) is power set defined on A = {a, b, c}.

13. Find the inverse of $A = \begin{bmatrix} 6 & 5 \\ 4 & -2 \end{bmatrix}$ and verify your result.

14. Use mathematical induction to prove that $1 + 2^n < 3^n$, for all $n \geq 2$.