Marks Scored:

KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2018

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

Course : MCSC 201
Semester: I

Exam Roll No. :

Time: 30 mins

F. M. : 20

Registration No.:

Date MAR 19 2018

SECTION "A"

[10 Q. × 1 = 10 marks]

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

1. The range of the floor function is ....
2. If GCD(a, b) = 1, then a and b are called .... prime.
3. $\lceil -27.3 \rceil$ = ...
4. The cycle of length 2 is known as ....
5. If $A = \begin{bmatrix} 2 & 5 \\ -3 & 1 \end{bmatrix}$ a square matrix, then A^2 = ...
6. The vertices of a tree that have no offspring are known as .... of that tree.
7. For the statements p, q, r, the dual of $(p \wedge q) \vee r$ is ....
8. The graph $\mathbf{K_5}$ with exactly 10 edges is ....
9. Every subgroup of an Abelian group is ....
10. The power set P(A) of A = {1, 2, 3, 4, 5} has .... elements.

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. The symmetric group S_5 of an equivalence triangle under the operation of composition is of order ....
    [100; 110; 120; 130]

12. A rooted tree (T, v_0) on a set is ....
    [reflexive; symmetric; asymmetric; antisymmetric]

13. The permutation $p = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 2 & 4 & 5 & 7 & 6 & 3 & 1 \end{pmatrix}$ is ....

[disjoint; even; odd; cycle]

14. If $\boldsymbol{L}$ is a lattice such that $a \wedge b = a$ for each a, b in $\boldsymbol{L}$, then we have ....

[$a < b$; $b < a$; $a \leq b$; $b \leq a$]

12. If we select any group of 1000 students on KU campus, then at least .... of them must have the same birthday.

[2; 3; 5; 6]

15. If 57 pigeons are assigned to 8 pigeonholes the one of the pigeonholes must contain at least .... pegions.

[6; 7 ; 8; 9]

16. If g is the mod-7 function, then g(1577) = ...

[0; 1; 2; 3]

18. The maximal element of the poset B = $\{x : x$ is a real number and $0 \leq x < 1\}$ with the usual partial order $\leq$, is ....

[0 ; 1/3 ; 1/2 ; 1]

19. A connected graph G with 10 vertices has Hamiltonian circuit if each vertex has degree greater than or equal to ....

[3; 5; 7 ; 10]

20. The probability that when two dices are rolled, the sum of the numbers on the top faces recorded being at least 7, is ....

[1/12; 5/12; 7/12; 11/22]

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MAR 1 9 2018

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. State the Division Algorithm Theorem and define GCD for integers. Also, use Euclidean algorithm to find GCD (d) of the integers a = 1986 and b = 1768 and then express d as sa + tb, for some integers s and t. [2+1+2+2]

2. What is meant by relation defined on a set? Also, define the complement & inverse operations on relations from a set A to another set B. If R and S ate relations from A to B, then prove that (i) $(R \cap S)^{-1} = R^{-1} \cap S^{-1}$ and (ii) $\overline{R \cap S} = \overline{R} \cup \overline{S}$. [1+2+ 4]

OR

Define an equivalence relation on a set? For the set A = **Z**, the set of integers, show that the relation R = {(a, b)∈A×A : a ≡ b (mod 5)} is an equivalence relation and also compute its quotient set. [2+ 4+1]

3. Define an Abelian group. Prove that the inverse element of a group if it exists, is unique. Also, verify that S = {1, -1, i, - i}, with $i = \sqrt{-1}$ and complex number multiplication is an Abelian group. [1 +2+ 4]

SECTION "D"
[6 Q. × 4 = 24 marks]

4. Find the inverse of the real function f defined as $f(x) = 5x + 7$ and verify your answer.

5. State the principle of mathematical induction and use it to prove that $1^2 + 2^2 + 3^2 + ... + n^2 = [n(n+1)(2n+1)]/6$, for all non negative integers n. [1+3]

6. For two lattices $(L_1, \leq)$, $(L_2, \leq)$, show that $(L, \leq)$ is a lattice where $L = L_1 \times L_2$ and partial order ≤ of L is the product partial order.

7. Define a Boolean matrix. Also, for Boolean matrices A, B, C of compatible orders, prove that (A ∨ B)∨C = A∨(B ∨ C), symbols have their usual meanings.

8. Find the transitive closure for the relation R defined on A ={ 1, 2, 3, 4, 5} by {(1, 1), (1, 2), (2, 3), (3, 4), (3, 5), (4, 5)}.

OR

If a graph G has more than two vertices of odd degree, then show that there can be no Euler path in G.

9. Solve the recurrence relation: $c_n = 4\,c_{n-1} + 5\,c_{n-2}$ with initial conditions $c_1 = 2$ and $c_2 = 6$. Also, give the first four terms of the sequence. [3+1]

SECTION "E"

[5 Q. × 2 = 10 marks]

10. Consider the Boolean polynomial $p(x, y, z) = (x \wedge y) \vee (x \vee (\sim y \wedge z))$ where symbols have their usual meanings. Then, construct the truth table for the Boolean function $T : B_3 \rightarrow B$ determined by this Boolean polynomial.

11. Determine the tree of the algebraic expression: $((2 + x) - (2 \times x)) - (x - 2)$.

12. If f_A denotes the characteristic function of a subset A of the universal set U, then prove that $f_{A \cup B} = f_A + f_B - f_A\, f_B$, where the symbols have their usual meanings.

13. Find the period of the permutation $p = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 3 & 5 & 1 & 2 & 6 \end{pmatrix}$ defined on A= {1, 2, 3, 4, 5, 6}.

14. Determine the Hasse diagram representing the positive divisors of 36.