Discrete Mathematics and Applications(18IT C05) – UNIT1

Short Answer Questions

1. Recall the converse, contrapositive, and inverse of the conditional   [CO1][R]
   statement P -> Q
2. Relate the converse, contrapositive and inverse of the following   [CO1][U]
   conditional statement
   "The home team wins whenever it is raining"
3. Infer the bitwise OR, bitwise AND, and bitwise XOR of the bit strings   [CO1][U]
   01 1011 0110 and 11 0001 1101
4. Define the following Terms   [CO1][R]
   a) Tautology
   b) Contradiction
   c) Contingency
5. Recall the following terms and illustrate with example   [CO1][R]
   a) Universal Quantification
   b) Existential quantification
6. Infer the negation of the statement "There is an honest politician"   [CO1][U]
7. Recall the following Inference Rules and illustrate with example   [CO1][R]
   a) Modus ponens
   b) Modus tollens
   c) Hypothetical syllogism
   d) Disjunctive syllogism
8. Tell about Rules of Inference for Quantified Statements   [CO1][R]
9. Define the following and give Examples.
   a) Set
   b) Empty Set
   c) Power Set
   d) Subsets
   e) union of the sets
   f) Intersection of the sets
10. Recall Computer Representation of Sets and illustrate with example   [CO1][R]
11. Tell about the following and illustrate with example   [CO1][R]
    a) Injective
    b) Surjective
    c) bijective.
    d) Inverse Function
    e) Compositions of Function
12. Relate the following function whether it is one-one or onto function   [CO1][U]
13. What is the remainder when −11 is divided by 3   [CO1][R]
14. Infer the decimal expansion of the number with octal expansion *(7016)8*?   [CO1][U]
15. Infer the octal expansion of *(12345)10*   [CO1][U]

16. Recall the following Algorithms and illustrate with example.   [CO1][R]
    a) Addition of Integers
    b) Multiplication of Integers
    c) Modular Exponentiation
17. Outline the inverse of 3 modulo 7?   [CO1][U]
18. Outline the solutions of the linear congruence $3x \equiv 4$ *(mod 7)*?   [CO1][U]
19. List the applications of Congruences.   [CO1][R]
20. Find the memory locations assigned by the hashing function   [CO1][U]
    $h(k) = k$ **mod** 111 to the records of customers with Social Security numbers
    064212848 and 037149212
21. Encrypt the plaintext message "STOP GLOBALWARMING" using the Caesar   [CO1][R]
    Cipher

Long Answer Questions

22. Build the logical expression for the following English sentence   [CO1][AP]
        "You cannot ride the roller coaster if you are under 4 feet tall unless you are
            older than 16 years old"
23. Show that the following conditional statement is a tautology by using   [CO1][U]
    truth table
        $\neg(p \rightarrow q) \rightarrow \neg q$
24. Identify Whether $\neg(p \lor q)$ and $\neg p \land \neg q$ are logically equivalent or not   [CO1][AP]
25. Model that $\neg(p \lor (\neg p \land q))$ and $\neg p \land \neg q$ are logically equivalent by   [CO1][AP]
    developing a series of logical equivalences
26. Identify the English statement for the following Logical expression   [CO1][AP]
    $\forall x \forall y ((x > 0) \land (y < 0) \rightarrow (xy < 0))$,
     where the domain for both variables consists of all real numbers   [CO1][AP]
27. Model the statement "Everyone has exactly one best friend" as a logical
    expression involving predicates, quantifiers with a domain consisting of all people,
    and logical connectives.

28. Model that the premises "It is not sunny this afternoon and it is colder than   [CO1][AP]
    yesterday," "We willgo swimming only if it is sunny," "If we do not go swimming,
    then we will take a canoe trip,"and "If we take a canoe trip, then we will be home by sunset"
    lead to the conclusion "We will be home by sunset."

29. Let $f : Z \rightarrow Z$ be such that $f(x) = x + 1$. Is f invertible, and if it is,   [CO1][U]
    Relate its inverse?

30. Let f and g be the functions from the set of integers to the set of integers   [CO1][AP]
    defined by $f(x) = 2x + 3$ and $g(x) = 3x + 2$. Identify the composition of f and g?
    Identify the composition of g and f?

31. Infer 3^{644} **mod** 645 value using Modular Exponentiation Algorithm   [CO1][U]

32. Solve the following problem   [CO1][AP]

There are certain things whose number is unknown. When divided by 3, the remainder is 2; when divided by 5, the remainder is 3; and when divided by 7, the remainder is 2. What will be the number of things?

33. Recall the procedure for generating pseudorandom numbers using   [CO1][R]
    linear congruential method and illustrate with example

34. Briefly explain about The RSA Cryptosystem and illustrate with example.   [CO1][U]