LNMIIT

The LNM Institute of Information Technology
Department Name: CSE-CCE

17UCS097

DMS
Exam Type(Mid Term)

Time: 90 Minutes   Date:23/02/2018   Max. Marks: 30

Instruction: Answer must be brief and to the point. No query will be handled in the exam room. If you have any issue regarding any question, write it into the answer-sheet and solve accordingly based on your own assumptions if required. (Mention your assumptions on the answer-sheet too). No marks will be awarded without proper reasoning.

Q1. Solve all parts with proper reasoning.   [1.5+1.5+1.5+1.5=6 Marks]

A. Rewrite the following sentence symbolically, where P(x): x is a 16-bit machine, Q(x): x uses the ASCII character set and UD is the collection of all computers
"We can find a computer that is either a 16-bit machine or does not use the ASCII character set."

B. Let UD is the set of real numbers and P(x, y): $y^2 < x$. Determine the truth value of the following expressions (a) $((\forall x)(\exists y)P(x,y)$ (b) $(\exists y)(\exists x)P(x,y)$

C. Test the validity of the following argument
H1: If Bill likes cats, he dislikes dogs
H2: Bill likes dogs

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Therefore, Bill dislikes cats.

D. Prove using the law of the contrapositive
"If the product of two integers is even, then at least one of them must be an even integer."

Q2. Solve all parts with proper reasoning.   [1.5+1.5+1.5+1.5=6 Marks]

A. Find the five words of the following language over $\Sigma = \{a, b\}$
$$L = \{x \in \Sigma^* \mid x \text{ contains an even number of } a\}$$

B. Let A and B be any two fuzzy sets then prove that $(A \cap B)' = A' \cup B'$

C. Using the sets A={a ,b, e, h}, B={b, c, e, f, h} and U={a, b, c, d, ..., h}, find the binary representation of the set $A \cup B'$

D. Determine if the following recursive definition yields the set S of legally paired parenthesis. If not, find a validly paired sequence that cannot be generated by this definition (a) ( ) $\in S$ (b) if $x \in S$ then $( )x, (x), x( ) \in S$

Q3. Solve all parts with proper reasoning.   [2.5+1.5+2.5+2.5=9 Marks]

A. If five points are chosen inside a unit square then show that the distance between at least two of them is no more than $\frac{\sqrt{2}}{2}$.

B. If n+1 integers are selected from the set {1, 2, 3, ..., 2n}, then show that one of them divides another integer that has been selected.

C. Prove that $N \times N$ is countable infinite.

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D. Which of the following relations on A = {x, y, z} are reflexive, ir-reflexive, symmetric, antisymmetric and transitive?
- $R1 = \{(x,x), (x,y), (y,y), (z,z)\}$
- $R2 = \{(x,y)\}$
- $R3 = \{(x,x), (x,z), (y,z), (z,x)\}$
- $R4 = \{\}$

Q4. Solve all parts with proper reasoning.   [2+2.5+2.5+2=9 Marks]

A. Show that $(p \rightarrow r) \wedge (q \rightarrow r)$ and $(p \vee q) \rightarrow r$ are logically equivalent.

B. Data stored on a computer disk or transmitted over a data network are usually represented as a string of bytes. Each byte is made up of 8 bits. How many bytes are required to encode 100 bits of data?

C. Prove or disprove that $[x + y] = [x] + [y]$ for all real x and y.

D. Suppose that the relation R on a set is represented by the matrix

$$M_R = \begin{bmatrix} 1 & 1 & 0 \\ 1 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$$ is R reflexive, ir-reflexive, symmetric and/or antisymmetric?