Register Number: ……………………..

MCA DEGREE EXAMINATIONS: MAY/ JUNE 2014

(Regulation 2013)

Second Semester

MASTER OF COMPUTER APPLICATIONS

P13MAT202: Mathematical Foundations of Computer Science

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions

PART A (10 x 2 = 10 Marks)

1. Find the rank of the matrix $\begin{pmatrix} 1 & -1 & 2 \\ 0 & 1 & -1 \\ -1 & 1 & -2 \end{pmatrix}$.

2. State the condition for which the system AX = B has a solution.

3. Prove that $A - (B - C) = (A - B) \cup (A \cap C)$.

4. Find $S \circ R$ where the matrices of R and S are $M_R = \begin{pmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}$ and $M_s = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 1 \end{pmatrix}$.

5. Prove the implication $\neg(P \to Q) \Rightarrow P$.

6. Write in a symbolize form: " If the labour market is perfect, then the wages of all persons in a particular employment are equal. But it is a case that wages for such persons are not equal. Therefore the labour market is not perfect".

7. Define phrase structure grammar.

8. In a grammar with productions $\{S \to 0B/1A; A \to 0/0S/1AA; B \to 1/1S/0BB\}$ for the string 00110101, find left most derivation.

9. Draw the state diagram for the given state table representing finite state automata and S_3 is the accepting state.

f	0	1
S_0	S_0,S_1	S_0,S_2
S_1	S_3	-
S_2	-	S_3
S_3	S_3	S_3

10. Define non deterministic finite state automata.

Answer any FIVE Questions

PART B (5 x 16 = 80 Marks)

Q.No:11 is Compulsory

11. (a) Find the eigen values and eigen vectors of the matrix $A = \begin{pmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{pmatrix}$. (8)

    (b) Obtain principle disjunctive normal form and principle conjunctive normal form of the formula: $(\neg P \to R) \wedge (Q \leftrightarrow P)$. (8)

12. (a) Test the consistency of the system of equations (8)
$x + y + z = 6$; $x - y + 2z = 5$; $3x + y + z = 8$; $2x - 2y + 3z = 7$ and hence solve if it exists

    (b) Evaluate $A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 - 8A^2 + 2A$ using Cayley Hamilton Theorem for the matrix $A = \begin{pmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{pmatrix}$ (8)

13. (a) In a survey of 100 students, it was found that 40 studied Mathematics, 64 studied Physics, 35 studied Chemistry. 1 studied all the three subjects 25 studied Mathematics and Physics, 3 studied Mathematics and Chemistry and 20 studied Physics and Chemistry. Find the number of students who studied only Chemistry and the number of students who studied none of these subjects. (8)

    (b) Prove that the function $f : R \to R$ defined by $f(x) = \dfrac{x}{x+4}$ is one to one and onto and hence find the inverse. (8)

14. (a) Prove that the following premises are inconsistent."If Ram misses many classes through illness then he fails high school. If Ram fails high school then he is uneducated. If Ram reads a lot of books then he is not uneducated. Ram misses (8)

many classes through illness and reads a lot of books".

(b) Prove that the following argument is valid. " In a triangle XYZ, there is no pair (8)
of angles of equal measure. If a triangle has two sides of equal lengths, then it is
isosceles. If a triangle is isosceles, then it has two angles of equal measure.
Hence triangle XYZ has no two sides of equal lengths."

15. (a) Explain various types of grammar. Construct a grammar for odd and even (8)
Palindrome over$\{0,1\}$.

(b) Prove that the language $L=\{0^n \,/\, n\,is\,a\,perfect\,square\}$ is not regular. (8)

16. (a) Design a finite state automaton that accepts the string of natural numbers 0 (8)
through 9 which are divisible by 3.

(b) Find the Deterministic Finite state Automata equivalent to Non- Deterministic (8)
Finite state Automata for which the state – table is given below and S_2 is the
accepting state.

	a	b
S_0	S_0,S_1	S_2
S_1	S_0	S_1
S_2	S_1	S_0,S_1

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