Post graduate Exam (Basic Engineering Sciences)
Branch: Engineering Mathematics (Master 500)

Menofia University Faculty of Engineering Academic Year: 2015-2016 Department: Basic Eng. Sci.	Minoufia University	Subject: basic topic in Linear Algebra Time Allowed: 3 hours Date: 6 / 6 / 2016 Max Marks: 100
Allowed Tables and Charts : None		

Answer all the following questions:

Q.1

(A) Write the tensors terms contained in $S = a_{ij}x^i x^j$ taking *n=3*.

(B) Compare between symmetric and anti-symmetric tensors.

(C) Use the mathematical induction to prove that:

i) $(a+b)^n = \sum_{k=0}^{n} \binom{n}{k} a^{n-k} b^k$

ii) $10^{n+1} + 3(10^n) + 5$ **is divisible by 9.**

for all natural numbers *n*.

(D) Define the orthogonal and positive definite tensors.

[Q.1 (30 mark)]

Q.2

(A) Find a solution of the following linear system ,if it is possible:

$$x_1 + 2x_2 + x_3 - x_4 + 2x_5 = 2$$
$$x_1 + 4x_2 + 5x_3 - 3x_4 + 8x_5 = -2$$
$$-2x_1 - x_2 + 4x_3 - x_4 + 5x_5 = -10$$
$$3x_1 + 7x_2 + 5x_3 - 4x_4 + 9x_5 = 4$$

(B) Given $A = \begin{bmatrix} -4 & 14 & 0 \\ -5 & 13 & 0 \\ -1 & 0 & 2 \end{bmatrix}$

i- Determine the inverse of A.

ii- Diagonalize A

iii- Find A^n

[Q.2 (30 mark)]

Q.3

(A) Using Boolean algebra techniques, simplify the expression:

$$AB + A(B + C) + B(B + C)$$

(B) Determine the truth table for the following standard POS expression:

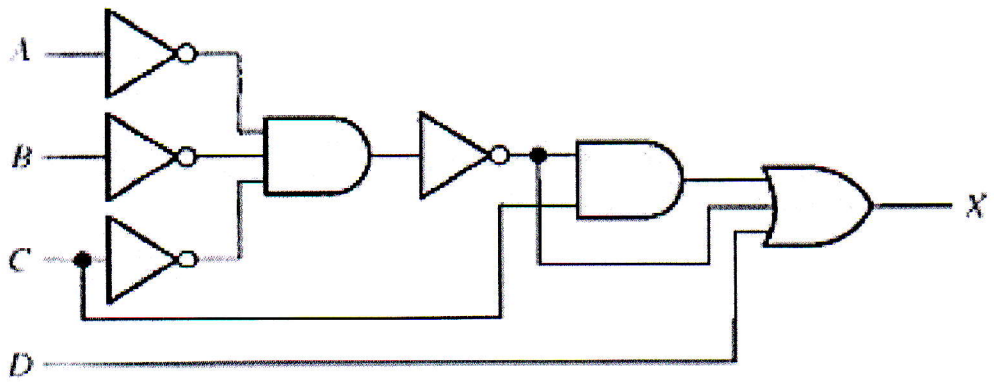
$$(A+B+C)(A+\overline{B}+C)(A+\overline{B}+\overline{C})(\overline{A}+B+\overline{C})(\overline{A}+\overline{B}+C)$$

(C) Map the following standard SOP expressions on a Karnaugh map:

i) $\overline{A}\overline{B}CD+\overline{A}B\overline{C}\overline{D}+AB\overline{C}D+ABCD+AB\overline{C}\overline{D}+\overline{A}\overline{B}\overline{C}D+A\overline{B}C\overline{D}$

ii) $(\overline{A}+\overline{B}+C+D)+(\overline{A}+B+\overline{C}+\overline{D})+(A+B+\overline{C}+D)$
$+(\overline{A}+\overline{B}+\overline{C}+\overline{D})+(A+B+\overline{C}+\overline{D})$

(D) Reduce the combinational logic circuit in the following figure to a minimum form.



[Q.3 (40 mark)]

With my best wishes

Dr. Z.M. Hendawy