Menoufia University
Faculty of Engineering, Shebien El-kom
Basic Eng. Science Department
First Semester Examination, 2013-2014
Date of Exam: 23 / 1/ 2014

Subject: Operations Research
Code : BES602
Year: Post Graduate
Time Allowed : 3 hours
Total Marks: 100 Marks

Answer the following questions

Question 1(30 marks)

(a). **(5 marks)** Define each of the following terms: Optimization, Pareto optimal solution, Artificial Intelligence

(b). **(10 marks)** Write common approaches for scalarizing multi-objective optimization problems, and explain two of these approaches.

(c) **(15 marks)** Using the necessary optimality conditions find the solution of the following problem

$$\text{Max } f(x_1,x_2) = \pi x_1^2 x_2$$

$$\text{Subject to } \quad 2\pi x_1^2 + 2\pi x_1 x_2 = A_0 = 24\pi$$

Question 2(25 marks)

(a). **(5 marks)** Write Kuhn-Tucker necessary optimality conditions

(b). **(20 marks)** Consider the following problem:

$$\text{Minimize } f(x_1,x_2) = (x_1-1)^2 + x_2^2$$

$$\text{subject to } \quad g_1(x_1,x_2) = x_1^3 - 2x_2 \le 0$$

$$g_2(x_1,x_2) = x_1^3 + 2x_2 \le 0$$

Determine whether the constraint qualification and the Kuhn–Tucker conditions are satisfied at the optimum point.

Question 3(45 marks)

(a) **(5 marks)** Draw schematic representation of an artificial neuron

(b) **(5 marks)** Describe three types of transfer function used with Artificial neuron

(c) **(10 marks)** Explain the learning and recall processes in artificial Neural network

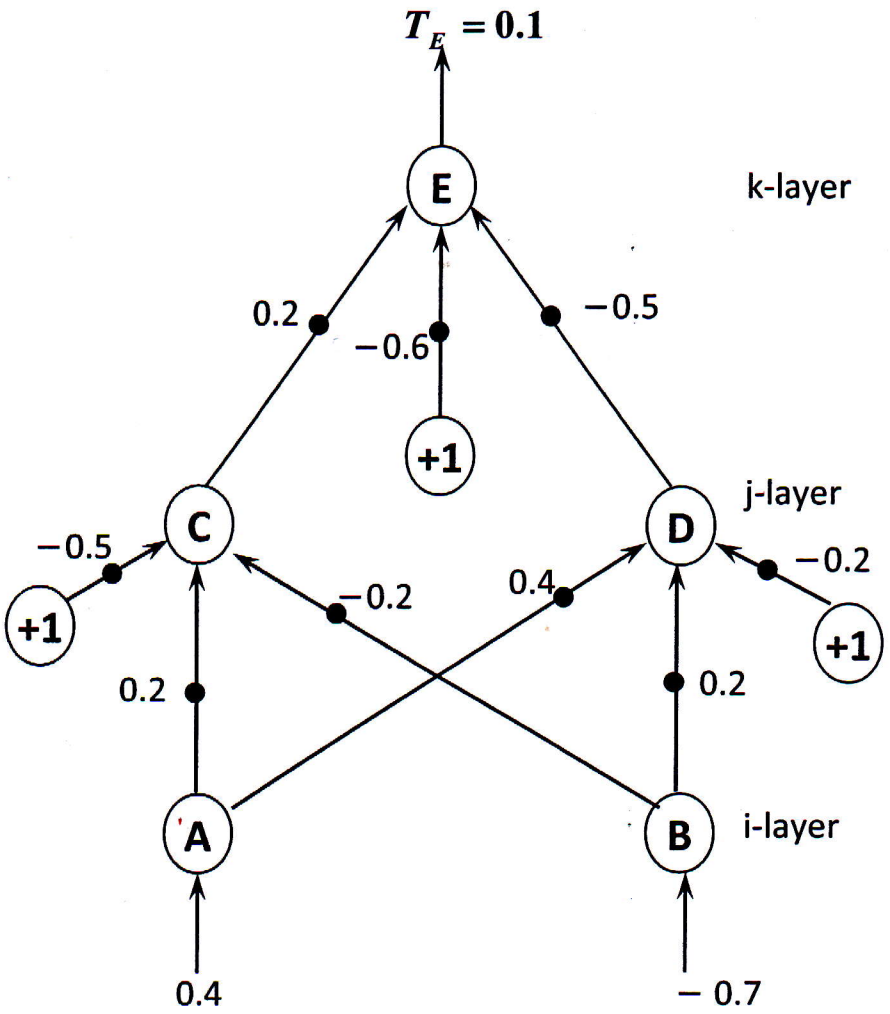
(d) **(25 marks)** A simple, fully connected feedforward neural network , where bias inputs of +1 and adjustable weights w_{1C} , w_{1D} and w_{1E} have been added to neurons C, D and E, respectively. All neuron have the same ***Logistic activation function*** with $\alpha = 1$ and the same ***learning constant*** $\eta = 0.5$. The desired output of neuron E is **0.1** . The weights are randomized to the values shown in figure, and training is started. Then the ***backpropagation*** process is carried through one cycle.

Calculate the new value of connected weights after updating process using ***backpropagation***.

Hint: for updating weights between layers ***j*** and ***k*** use equation (1), and between ***i*** and ***j*** use equation (2)

$$(1)\,\Delta w_{pq.k} = -\eta_{p.q}\left[-2\alpha\left(T_q - \Phi_{q.k}\right)\Phi_{q.k}\left(1-\Phi_{q.k}\right)\Phi_{p.j}\right]$$

$$(2)\ \Delta w_{hp.j} = -\eta_{h.p}\left[\sum_{q=1}^{r}-2\alpha\left(T_q - \Phi_{q.k}\right)\Phi_{q.k}\left(1-\Phi_{q.k}\right)w_{pq.k}(\alpha)\Phi_{p.j}(1-\Phi_{p.j})x_h\right]$$



With our best wishes

This exam measures the following ILOs															
Question Number	Q1-a	Q2-a	Q3-a			Q1-b	Q3-b				Q1-c	Q2-b	Q3-c		
Skills	a2-2	a4-1	a5-1			b2-1	b5-1				c4-2	c5-1	c7-2		
	Knowledge& Understanding Skills					Intellectual Skills					Professional Skills				