Alexandria University
Faculty of Engineering
Mechanical Engineering Department
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جامعة الاسكندرية
كلية الهندسة
قسم الهندسة الميكانيكية
2016 ديسمبر

Optimum Design	التصميم الأمثل
Fourth Year	السنة الرابعة
Time Allowed: 1 Hour	الزمن: 1 ساعة

Answer the following questions:

QUESTION ONE (10 points):

Graphically solve the optimal design problem given below.

$$\text{Maximize } F(x1, x2) = x_1 + 4x_2$$

Subject to
$$x_1 + 4x_2 \geq 48$$
$$5x_1 + 4x_2 \geq 50$$
$$x_1, x_2 \geq 0$$

Show all constrains (with hatch marks to indicate the infeasible side)
Show at least two contours of *F(x)*
Find the Optimal Solution and Label it on the graph
Fill in the blanks at the bottom

Approximate optimal solution $x_1^* =$ _____ , $x_2^* =$ _____ .

Approximate Optimal value $f(x^*) =$ _____ .

QUESTION TWO (10 points):

A fertilizer company purchases nitrates, phosphates, potash, and an inert chalk base at a cost of $1500, $500, $1000, and $100 per ton, respectively, and produces four fertilizers A, B,C, and D. The production cost, selling price, and composition of the four fertilizers are given below:

Fertilizer	Production cost ($/ton)	Selling price ($/ton)	Percentage composition by weight			
			Nitrates	Phosphates	Potash	Inert chalk base
A	100	350	5	10	5	80
B	150	550	5	15	10	70
C	200	450	10	20	10	60
D	250	700	15	5	15	65

During any week, no more than 1000 tons of nitrate, 2000 tons of phosphates, and 1500 tons of potash will be available. The company is required to supply a minimum of 5000 tons of fertilizer A and 4000 tons of fertilizer D per week to its customers; but it is otherwise free to produce the fertilizers in any quantities it pleases. Formulate the problem of finding the quantity of each fertilizer to be produced by the company to maximize its profit.