In-Class Assignment I

Course: Modeling and Optimization   Date: 11/09/2018
                                           Time duration: 1 hour
Student's name: _____   Total Marks: 100

Each question carries 20 marks.

Question 1) You are responsible for managing the inventory for a trendy upscale specialty food store. You are trying to set the inventory policy for one of your most popular cheeses, *Mad Cow Cheddar*.

You have been told that the total annual cost related to this product depends on the value of the order quantity (Q) with the following formula:

$$\text{Total annual cost} = 12100 + 24000/Q + 0.15Q$$

What should your order quantity (Q^*) be, in order to minimize the total annual cost?

Question 2) Write down the set of inequalities that is represented as the feasible region (gray area) in the below figure. (Hint: Use BigM).
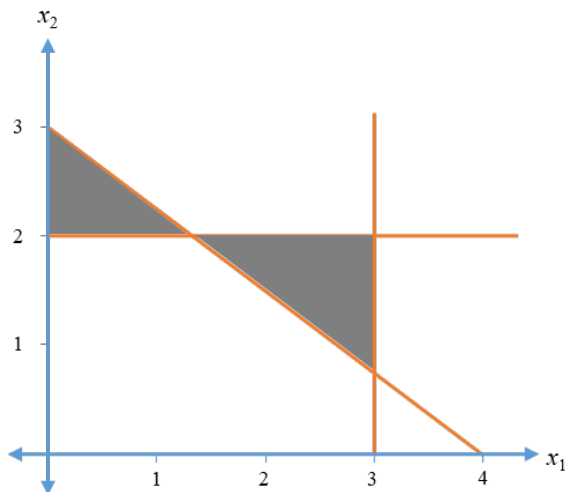
Question 3) A furniture manufacturer produces two types of display cabinets, type X and type Y. On a weekly basis he must produce at least 2 of each type, but not more than 5 of type X and not more than 6 of type Y. It takes 4 hours to produce type X and 5 hours for type Y in a 40 hour working week. The production line cannot make both types at the same time so each type takes its own time. To produce one unit of type X we need 2 workers and 3 workers for type Y. Because of some rules in the production line, if a worker is involved in producing a unit of cabinet, we cannot use him again to produce any other cabinets. There is one more restriction that we need to have at least 12 workers in total.

1. Represent the above information as a system of inequalities .

2. Draw a graph of the system and indicate the feasible region clearly.

3. If the profit (P) on type X is $800NOK$ and on type Y is $1000NOK$, write down the objective function in the form $P = ax + by$.
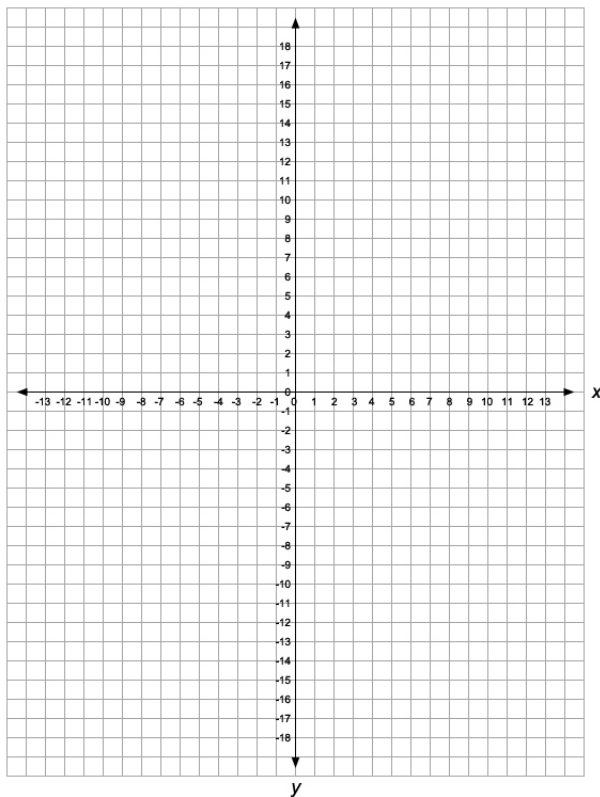
Question 4) A cargo plane has three compartments for storing cargo: front, centre and rear. These compartments have the following limits on both weight and space:

Compartment	Weight capacity (tons)	Space capacity (cubic metres)
Front	10	6800
Centre	16	8700
Rear	8	5300

Furthermore, to maintain the balance of the plane, the ratio of weight to the capacity for all compartments must be the same. The following four cargoes are available for shipment on the next flight:

Cargo	Weight (tons)	Volume (cubic metres/ton)	Profit (/ton)
C_1	18	480	310
C_2	15	650	380
C_3	23	580	350
C_4	12	390	285

Any proportion of these cargoes can be accepted. The objective is to determine *how much* (if any) of each cargo C_1, C_2, C_3 and C_4 should be accepted and how to distribute each among the compartments so that the total profit for the flight is maximized. Formulate the above problem as a linear program.

Question 5) The Blue City Company owns a small paint factory that produces both interior and exterior house paints for wholesale distribution. Three basic raw materials, A, B and C are used to manufacture the paints. The maximum availability of A is 8 tons a day; that of B is 10 tons a day and for C in unlimited. The daily requirement of the raw materials per ton of the interior and exterior paints are summarized in the following table:

raw material	Exterior	Interior	Maximum Availability (tons)
A	1	2	8
B	2	1	10
C	2	3	unlimited

Tons of raw material per ton of paint

A market survey has established that the daily demand for interior paint cannot exceed that of exterior paint by more than 1 ton. The survey also shows that the maximum demand for interior paint is limited to 2 tons daily. The wholesale price per ton is \$3000 for exterior paint and \$2000 for interior paint.

The objective is to determine how much interior and exterior paints the company should produce daily to maximize gross income. Formulate the above problem as a LP.