ORIGINAL

Examination: 5074 Management IV
Production Management and Operations Research
Examiner: Prof. Dr. J. Heizer

The following aids can be used: Calculator, subject to Examination Office stated policy.

Instructions: There are 7 questions, and all must be attempted. All questions are assigned weights, which sum to 100%. Question 6 is worth 20 points; Questions 1, 4, 5, and 7 are worth 15 points; Questions 2 and 3 are worth 10 points. Good Luck!

1. Linear Programming (15 points)

a) Solve the following LP graphically:

$$Z = 4x_1 + 5x_2 \rightarrow Min!$$
$$s.t.$$
$$x_1 + 2x_2 \geq 80$$
$$3x_1 + x_2 \geq 75$$
$$x_1, x_2 \geq 0$$

b) What is the optimal solution:

c) What is the value of the objective function at the optimum:

2. Location Choice (Center of Gravity) (10 points)

A firm is preparing to open a distribution center to serve it's market in East Germany. The following information is given:

	X coordinate	Y coordinate	Volume
Magdeburg	30	40	100
Erfurt	20	10	400
Frankfurt (Oder)	50	60	100
Dresden	10	70	200

a) What is the center of gravity?

b) What is the distance from the center of gravity to Magdeburg?

c) What would be the rectangular distance from the center of gravity to Magdeburg?

3. Productivity Measurement (10 points)

A certain worker at a work center in a factory has an actual cycle time of 10 minutes. The performance rating of the worker timed was 90%. The department allows 9% allowances.

a) Find the Normal Time for the operation.

b) Compute the Standard Time.

c) If, due to a new heat treating process, the allowance was increased to 16%, what would be the new Standard Time?

4. Inventory Management (15 points)

A certain product in inventory has order costs of $8 / order, and holding costs of $1 / unit per year. The demand per annum is 2400 units. Ascertain the total relevant costs of the following policies.

a) Order 2,400 units once per year.

b) Order 600 units each quarter

c) Order 200 units each month

Using the following notation, derive the economic order quantity (EOQ)

D = Demand h = Holding cost S= Order Cost Q= Order Quantity

d) Derive the EOQ:

e) What would be the EOQ for the above problem, and what would be the resulting costs.

5. Statistical Process Control (15 points)

A specific product should weigh exactly 32.0 grams. As a Quality Control Manager of a medium size manufacturing firm in the Magdeburg area, you wish to develop process control charts. Using the following, compute lower and upper control limits and determine if the process is in control or not, assuming a 3 sigma standard.

Sample	Mean (grams)	Range (grams)
1	33,8	1
2	34,4	0,3
3	34,5	0,5
4	34,1	0,7
5	34,2	0,2
6	34,3	0,4
7	33,9	0,5
8	34,0	0,8
9	33,8	0,3
10	34,0	0,3

a) Determine Upper and Lower control limits for the Mean (X-bar) Chart

b) Determine Upper and Lower control limits for the Range Chart

c) Is the process in control? Why or why not?

6. Simplex Method (20 points)

Solve the following LP using the Simplex Method:

$$\pi = 7x_1 + 5x_2 \quad \rightarrow \quad Max!$$

$$s.t.$$

$$4x_1 + 3x_2 \leq 240$$

$$2x_1 + x_2 \leq 100$$

$$x_1, x_2 \geq 0$$

a) Setup the initial Simplex Tableau.

b) Pivot the tableau to the second Tableau.

c) Pivot to optimality.

d) Give the optimal values of the two decision variables.

e) Give the value of the objective function at this point.

7. Statistical Process Control (15 points)

Clean Needle Jack's

Clean Needle Jack's is a seedy Tattoo and Piercing joint located in Morgan City, Louisiana. Jack sells a variety of tattoo and piercing products and is interested in obtaining information concerning the amount of each product he needs to sell in order to break even. The following information is given:

Product	Price	Cost	Forecasted Volume
Small Tattoo	$55.00	$30.00	600
Large Tattoo	$95.00	$50.00	300
Nose Piercing	$35.00	$15.00	300
Mouth Piercing	$85.00	$30.00	150
'Special' Piercing	$200.00	$150.00	50

Jack's Fixed Costs are as follows:

Jack's Salary	$19,000
Rent	$13,000
Other Overhead	$11,000

As Jack's Business Consultant, your job is to:

a) Determine the multi product break even point in sales per year …

b) Using this information, determine how much of each product will be sold according to this method, and lastly …

c) Prove that the solution method works (Jack is very skeptical).