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Name:

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EXAM: 5074

Management IV (Production Management and Operations Research)

Prof. Dr. J. H. Heizer

Wintersemester; 2001-2002

The following aids can be used: Non-programmable calculator

### Examination Questions:

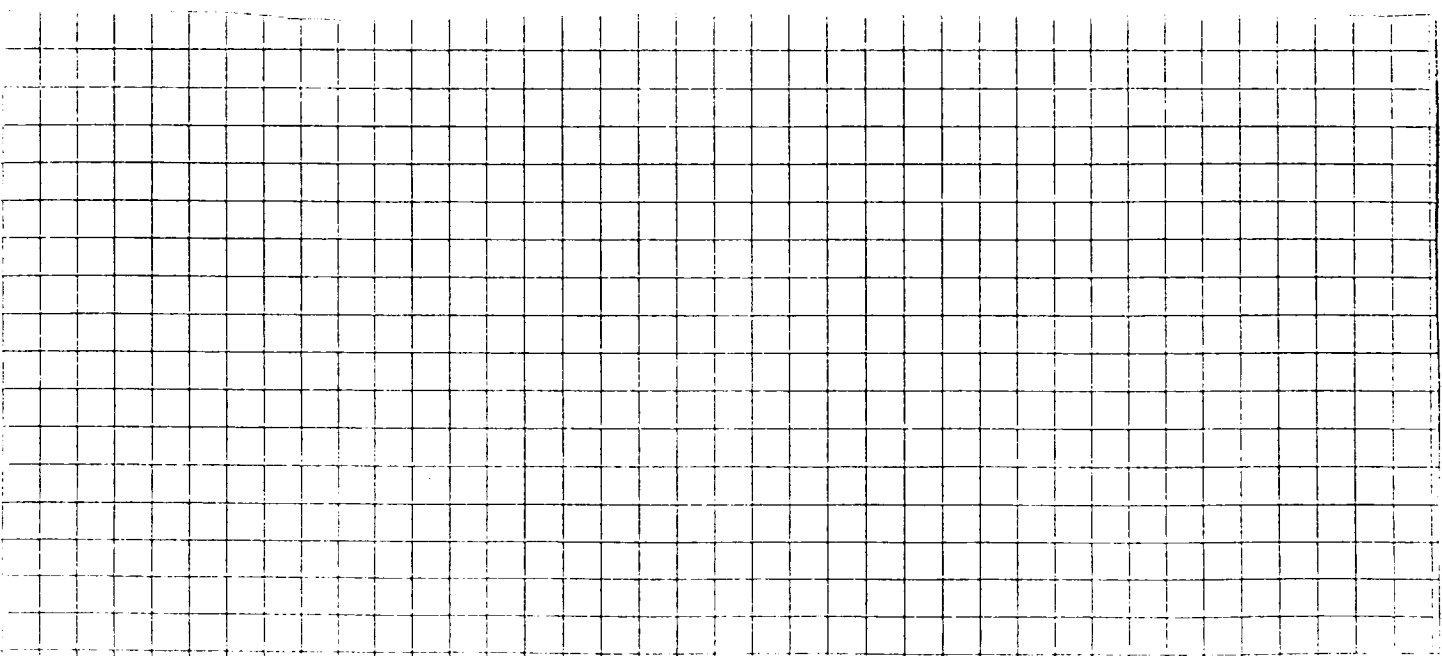
The first question is required and consists of 25% of the exam grade.  
The remaining 75% requires answering 5 of the 6 remaining questions.

#### The first question (REQUIRED):

(25 pts.) Langella GmbH is opening a new manufacturing facility in Burg where they will be producing two types of shower enclosures, the larger curved deluxe model ( $X_1$ ) and the standard square model ( $X_2$ ). The production process for both is similar, as both require cutting plastic sheets and extruded aluminum to size in the 'cutting shop'. The second process requires drilling, and fitting, and assembly in the 'assembly shop'. Enrico Langella estimates that the profit on the deluxe model is about 9 € and the profit on the standard model is 7 €. The standard model takes only 1 hour in the cutting shop, but 3 hours in the assembly shop. The deluxe model takes 2 hours in the cutting shop and 1-hour in the assembly shop. The cutting shop has 40 hours available. The assembly shop has 30 hours available.

a. (4 pts) Define the objective function and constraints.

b. (4 pts) Solve the problem graphically.



c. (4 pts) How much profit will Langella GmbH make with the optimum product mix?

6. (15 pts) The quality assurance supervisor at Magdeburg Pizza has just given you the data for tracking the means of a process that puts a spice into the tomato sauce. The sample size is 5 ( $n=5$ ), and the mean of 12 samples in grams are: 46, 45, 46, 47, 48, 47, 50, 49, 51, 52, 50, 52. The desired mean of the process is 47.0 grams and the desired standard deviation is 1.0 grams.
- a. (5 pts) Determine the upper and lower control limits. Use the desired mean of 47.0 grams and the conventional 3 standard deviations limits on the control chart to determine the upper and lower control limits.
- b. (3 pts) Draw the control chart and plot the 12 samples.
- c. (3pts.) Explain the results noted in the plot above.
- c. (4 pts) What is the limitation of this analysis from a statistical process control perspective?

d. (4pts) Set-up this problem in the standard simplex tableau used in linear programming.

e. (4 pts ) Identify the initial pivot row and initial pivot column and explain why these are the pivot row and pivot column?

f. (5 pts) Compute the second tableau.

5. (15 pts) As the new manager of the Berlinerhof Hotel you are reviewing the room rates. The preceding manager had one room rate of 80 € per night per room and an average occupancy of 60%. The hotel has 100 rooms. Variable cost (cleaning, fresh towels and linens, etc.) is 15 € per room. Fixed cost is 3,000 € per day.

You believe that a price structure that provides discounts to seniors and a 'corporate' discount to regular customers would increase revenue. You propose to have a senior rate of 70 € and corporate rate of 60 €. You believe that you can still fill 50% of the rooms at the 80 € rate, while filling an additional 10% of the rooms at the senior rate and another 10% at the 'corporate' rate.

- a. (5 pts) What was breakeven (in Euros and occupancy) under the previous manager?

Breakeven in Euros =

Breakeven in occupancy =

- b. (7 pts) What is breakeven (in Euros and occupancy) under your plan?

Breakeven in Euros =

Breakeven in occupancy =

- c. (3 pts) Which plan is the better plan and why?

**Answer / Solve 5 of the following 6 problems. (15 pts each)**

1. (15 pts) Define the following terms (1 ½ points for each correct definition):

Kanban

Poka Yoke

JIT

MRP

EOQ

Exponential Smoothing

Cpk

Quality Loss Function

Cause and Effect diagram

Pareto chart

4. (15 pts) Installation of a new computer system in your office requires the following activities.

Activity	Preceding Activity	Days Required
A	none	4
B	A	2
C	A	12
D	A	3
E	B	5
F	D	1
G	B	7
H	C,E	2
I	G,F	10
J	H,I	4

- (3 pts) What task must be on the critical path regardless of activity duration?
- (2 pts) What is the duration of A, B, E, H, J?
- (2 pts) What is the critical path of this network?
- (2 pts) What is the length of the critical path?
- (2 pts) What is the slack time for activity H?
- (2 pts) What is the late finish time for activity H?
- (2pts) If the subcontractor for activity C delays the project by 2 days, what is the impact on the project duration?

2. (15 pts) As proprietor of Harz Products you produce a rustic Christmas widow decoration for the Christmas season. The completed decoration (A) consists of a base (B), and the wood carving (C). The base consists of a plate (P) and three fasteners (F). There are currently 30 carvings and 100 bases on hand (in inventory). Final assembly takes one week. The carvings have a lead-time of 3 weeks. All other parts have a lead-time of 1 week. There are no scheduled receipts. All components are ordered on a lot-for-lot rule. The master production schedule has been developed in weeks and calls for 100 units to be completed in week 5 and another 150 units in week 8.

You have a small shop and limited space and capital so good scheduling makes a significant difference on your productivity and profitability.

a. (10 pts) Prepare the master production schedule for the next 8 weeks, showing all of the planned order releases.

b. (5 pts) If you must pay cash on delivery for the carvings and your cost for each carving is 10 €, how much cash must you have and when to pay for the carvings?

3. (15 pts.) Pizza Products of Magdeburg, because of the fluctuating student population, has a variable product demand for the next 4 weeks as shown below. You have prepared some cost data related to the production schedule which is also shown below.

<u>Week</u>	<u>Demand</u>
1	1400
2	1200
3	1500
4	1300

Previous week's output	1500 pizzas
Beginning inventory	200 pizzas
Stockout cost	5 € per pizza
Inventory holding cost	10 € per pizza
Hiring workers	4 € per pizza
Firing workers	8 € per pizza
Unit cost	30 € per pizza
Overtime	10 € extra per pizza

Your job is to prepare a production schedule. You want to evaluate two production schedules. One schedule holds production steady at your normal capacity of 1200 pizzas per week and uses overtime to meet demand (Plan A). Another option is to produce to the schedule by hiring and terminating employees. (Plan B)

a. (Plan A) What is your cost if you reduce production from the previous week's 1500 to 1200 in week 1 and hold production steady at 1200 pizzas and use overtime for the extra production? (Note: you have 200 pizzas in inventory when you begin production in week 1).

b. (Plan B) What is going to be the cost if you allow production to be the same as demand by hiring and terminating employees? (Remember: the previous week's production was 1500 units and you have 200 in inventory)