Otto-von-Guericke-University Magdeburg
Faculty of Economics and Management
- Management Science -
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End-Term Test
Production Management & Operations Research (5074)
July 22, 2005

Last name: ..... **First name:** ..... **Matriculation No.:** .....

Examination: Production Management & Operations Research SS 2005
Examiner: Prof. Dr. G. Wäscher

General remarks:

1. Write your name and matriculation number on this cover sheet and on every other sheet that has been issued to you.
2. Leave a minimum of 4 cm as correction space on the outside margin of each page.
3. Make sure that you have a complete copy of the test. The test consists of **3 assignments**, all of which have to be dealt with. It is not permitted to remove the retaining clip; doing so will be treated as fraudulent behaviour.
4. Please write legibly and number the pages which have been used. For each assignment, put down your answers on a separate sheet. Only pens with permanent ink may be used, while correction pens or ink erasers are not permitted. Make sure that you don't write in red.
5. Always make clear how you have determined your solution (solution path). Isolated solutions without traceable origin will not be accepted.
6. The following aids may be used: writing utensils, non-programmable pocket calculators without communicating and/or data processing functions, dictionaries (without any added

Assignment 1 (22 points)

A company that produces burglar-proof doors buys the door-handles from a supplier. On the basis of the planned product-mix, a precise forecast of the demand for door-handles can be made for the next five weeks (which is identical with the total planning period). The demands are given in the table below.

week	t	1	2	3	4	5
demand for door-handles	n_t	10	50	20	10	70

The (decision-relevant) ordering cost amounts to € 100. In case that it is necessary to store some of the handles, it costs € 1 to keep one door-handle in stock for one week.

The inventory at the beginning of week 1 is zero; the planned inventory at the end of week 5 is also zero. Ordered door-handles arrive on Monday, shortly before production begins. Likewise, withdrawals from stock – if necessary – are made on Monday morning only.

The purchasing department would like to determine a purchasing policy which minimizes the sum of ordering and holding cost.

a) Determine an ordering policy by means of the Least-Unit-Cost heuristic. Also give the corresponding ordering, holding and total cost for the total planning period. Don't forget to formulate the cut-off criterion explicitly!

b) Determine an ordering policy by means of the Silver-Meal heuristic. Also give the corresponding ordering, holding and total cost for the total planning period. Don't forget to formulate the cut-off criterion explicitly!

c) On which properties of the underlying Wagner-Whitin-Model are the two above-mentioned heuristics based? In other words, why is it reasonable to use the given cut-off criteria?

Assignment 2 (20 points)

A company manufactures five product types in a three-stage production process. The operation times of the corresponding production orders (A, B, C, D, E) on the different stages are given in the table below.

production stage / production order	(1)	(2)	(3)
A	2	10	5
B	8	5	6
C	5	9	6
D	11	1	3
E	4	7	7

The sequence of stages which the orders have to pass through is identical for all orders; overtaking of orders is not possible due to technical reasons.

a) The production manager wants to find an order sequence with a cycle time as small as possible. Use Johnson's algorithm to find such an order sequence. Give the sequence and the corresponding cycle time!

b) Is the obtained solution optimal?

Now assume that the company had a technical update which permits orders overtaking each other.

c) Determine an order sequence by means of the Shortest Operation Time Rule. Also give the corresponding cycle time!

Assignment 3 (8 points)

A company wants to carry out a project that consists of several activities. The relationship between the different activities as well as their duration in days are given in the following table.

activity	duration	direct predecessors	direct successors
A	4	–	D, F
B	7	–	F
C	8	D	–
D	1	A	C, G
E	6	F	–
F	5	A, B	E, G
G	4	D, F	–

Develop an activity-on-node network that represents the project. What is the minimal duration of the project? Only carry out the calculations which are necessary for answering this question!