



## End-Term Test

### Production Management & Operations Research

February 09, 2004

Last name: ..... First name: ..... Matriculation number: .....

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

WS 2003/2004

The following aids may be used: calculators  
dictionaries

Number of examination questions: 2

#### Assignment # 1 (25 points)

A company buys a particular component from a supplier. The corresponding demand for the forthcoming six months (planning period) has been forecasted as follows:

month t	1	2	3	4	5	6
demand $n_t$	50	40	60	80	100	10

The costs of placing one order (ordering costs) are 600 Euro, the holding costs amount to 2 Euro per month for each stored product unit.

The following assumptions can be made:

- Ordered products are received at the beginning of the month and can be processed without delays. Likewise, stored products can only be retrieved from the warehouse at the beginning of each month.
- Inventory at the beginning of the total planning period is zero. Inventory at the end of the planning period is required to be zero. No other inventory restrictions apply.

Determine an ordering policy by means of the Least-Unit-Cost-heuristic and the Silver-Meal-heuristic! What are the corresponding total costs?

In a second scenario, due to storage-space limitations, the maximal inventory is limited to 170 units. How could this additional constraint be included in the above-mentioned methods? What would be the solutions provided by the modified methods? Repeat your calculations only if necessary.

## Assignment # 2 (25 points)

The following table lists those work elements (operations), which have to be carried out on a production line on which computer keyboards of a specific type are produced. The list also includes information on the operation times of the work elements and the relevant precedence relationships.

work element i	operation time $t_i$ [sec]	direct predecessor(s)
1	32	-
2	48	-
3	40	2
4	27	1, 2
5	13	1, 3
6	43	3
7	49	5, 4
8	48	6, 7

The desired average output rate is 30 keyboards per hour.

- What are the assumptions of the priority-based methods for production line balancing?
- What is the maximal cycle time, which cannot be exceeded if 30 keyboards are to be produced per hour?
- What is the theoretical minimum number of work stations for the desired output rate?
- For the precedence relationships given in the above table, plot the corresponding precedence diagram!
- Assign the work elements according to the method of Helgeson and Bernie!
- How many work stations are necessary? Also determine the total idle time and the capacity utilization of this solution!
- Can you decide whether the solution is an optimal one? Give reasons!