Otto-von-Guericke-University Magdeburg
Faculty of Economics and Management
- Management Science -
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ManSci

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End-Term Test

Production Management & Operations Research

(5074)

July 23, 2004

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

Examination: Production Management & Operations Research **SS 2004**
Examiner: Prof. Dr. G. Wäscher

The following aids may be used: **calculators** (non-programmable, without communicating and/or data processing functions)
dictionaries (without own remarks)

Number of examination questions: 4

Assignment # 1 (15 points)

A company wants to determine the optimal ordering policy for a particular product. Its demands for the forthcoming five months have been forecasted as follows:

month	t	1	2	3	4	5
demand	n_t	10	2	5	8	10

The (decision-relevant) ordering costs amount to € 10 per order. The storing of products causes holding cost of € 1 per unit and month. There is no inventory available at the beginning of the first month. Furthermore, there should be no inventory at the end of month five.

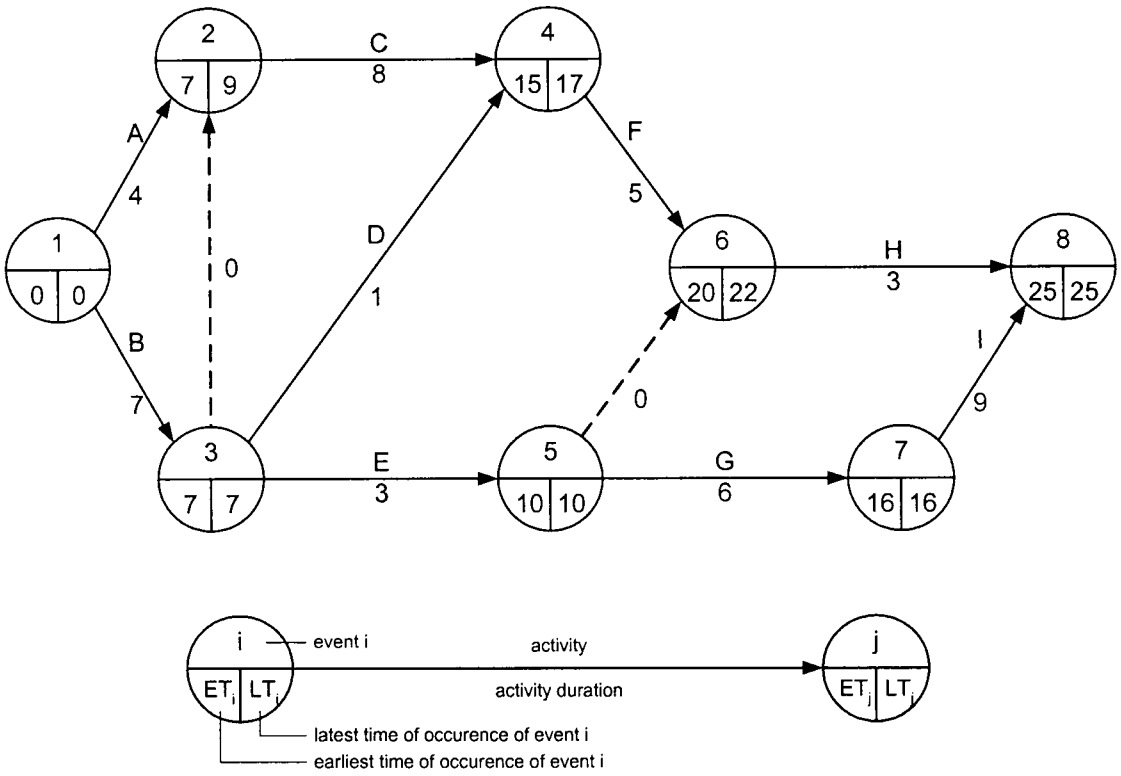
a) Determine an ordering policy by means of the Least-Unit-Cost-Heuristic!

b) Represent the problem as a shortest-path problem in a directed graph!

c) Prove that the solution provided by the Least-Unit-Cost-Heuristic is an optimal one for this numerical example!

Assignment # 2 (8 points)

Let a project be represented by the following activity-on-arc network:



a) Develop a work-breakdown structure of the project. Use this structure in order to represent the project in an activity-on-node network!

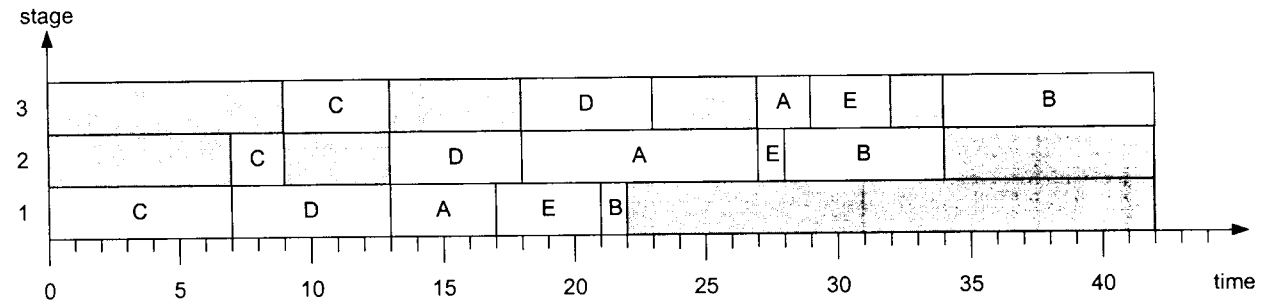
b) The project manager has been informed that activity F takes two time units longer than initially expected. Will that affect the earliest finish time of the project? Give reasons!

Assignment # 3 (12 points)

A company produces five types of products (A, B, C, D, E); each product has to pass through three stages. The operation times are given by the following table:

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

The following GANTT-chart gives an order sequence that the company has been using in the past.



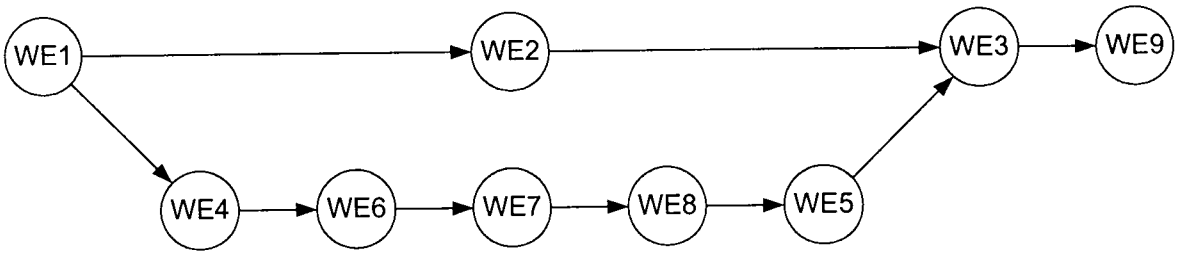
a) Identify the following information from the chart:
   - cycle time;
   - capacity utilisation of stage 2;
   - total waiting time of order E!

b) Suppose that the orders must not overtake each other. Use Johnson's algorithm to find an order sequence with a cycle time shorter than the given one! (Remark: You don't need to draw the GANTT-chart.)
   What is the cycle time of the new sequence? What is the capacity utilisation of stage 2? What can you say about the optimality of the above-given and the newly generated sequences?

Assignment # 4 (15 points)

Let a flow-line balancing problem be defined by the following list of work elements (WE1 - WE9) and the corresponding precedence graph.

work element	operation time [min]
WE1	4
WE2	3
WE3	11
WE4	7
WE5	2
WE6	4
WE7	6
WE8	9
WE9	3



a) Let the cycle time be 11 minutes. Determine the ranked positional weights of the work elements according to Helgeson/Bernie! Use the corresponding priorities and assign the work elements to stations! What can you say about the optimality of this solution?

b) The introduction of a new technology allows to process all operations independently (there are no precedence relationships). The operation times are given as above, and the cycle time is set to 11 minutes again. Assign the work elements to work stations according to the First-Fit-Decreasing Principle! What can you say about the optimality of this solution?