Homework 1

1. Draw a project network in both activity-on-the-node and activity-on-the-arc (with a minimal number of dummy activities) format using the data given below:

Activity	Duration	Predecessor(s)
a	3	-
b	2	-
С	5	-
d	4	<i>a</i> , <i>b</i>
e	3	b
f	1	<i>b</i> , <i>c</i>
g	5	<i>d</i> , <i>f</i>
h	4	e, f

Compute for each activity in both representations the total slack, safety slack, free slack and independent slack values. Comment on potential differences in the values that might occur.

2. Consider the following project network in activity-on-the-node representation:

Availability: 10



In this representation, each node first contains the activity number and the duration on the first line, while on the next line the resource requirements for the two resource types are given. Assuming that a feasible schedule for this project can be found with a makespan of 16, construct a mathematical programming formulation that will find the optimal schedule and that is based on on/off time-indexed step variables. 3. Consider the following data for a resource-constrained project:

Activity	Duration (periods)	Immediate predecessors	Resource requirement (units/period)
1	5	Filester	1
1	3	-	1
2	2	-	1
3	3	-	2
4	2	2	3

The single renewable resource has a per period availability of 3 units. The precedence relations are of the finish-start type with minimal zero-time lag.

Answer the following questions:

- Draw the project network in activity-on-the-node format, identify the critical path and compute its length.
- Assume that the branch-and-bound procedure of Demeulemeester-Herroelen is applied under the
 objective of minimizing the project duration. At what <u>time instant</u> will the procedure detect its
 first resource conflict? Compute the minimal delaying set and the minimal delaying alternatives.
 Explain your answer in sufficient detail.
- Compute for each minimal delaying alternative a critical path based lower bound and a critical sequence based lower bound on the optimal project duration. Explain all your computational steps in sufficient detail.
- Draw the partial branch-and-bound search tree and identify the node from which branching will continue.
- 4. Consider the following project network in activity-on-the-node representation:



Apply the DH-procedure in order to find the optimal makespan for this project.