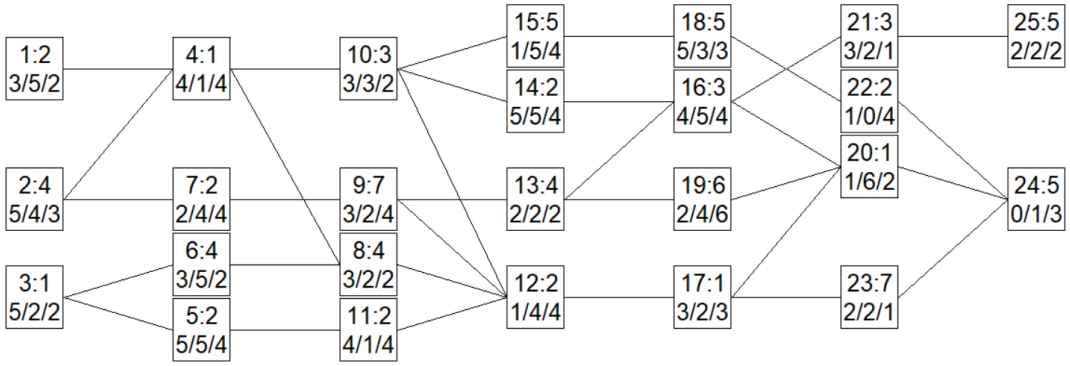
Homework 2

1. Using the RESCON software, find the cheapest resource assignment for problem “Pat100.rcp” (to be found on Toledo) given a project deadline of 35 when the unit costs for the different resource availabilities are $c_1 = 9$, $c_2 = 2$ and $c_3 = 4$. Below you can find the representation of the network as well as some tables that represent the optimal makespan given the corresponding resource availabilities for the three resource types (the rows represent the availability of resource type 2, while the columns represent the availability of resource type 3). For your information: you can use a resource availability of 12 if you want to consider an infinite resource availability for a certain resource type.

Availability: 10/10/10



$a_1 = 5$	6	7	8	9	10	11	12
6	67	63	61	61	61	61	61
7	63	57	57	57	57	57	57
8	62	57	56	56	55	55	55
9	62	57	55	54	54	54	54
10	61	56	54	54	54	54	54
11	61	56	54	54	54	54	54
12	61	56	54	54	54	54	54

$a_1 = 6$	6	7	8	9	10	11	12
6	62	57	56	56	56	56	56
7	55	50	49	49	49	49	49
8	54	50	48	48	48	48	48
9	52	49	46	46	46	46	46
10	52	49	46	46	45	45	45
11	52	49	46	46	45	45	45
12	52	49	46	46	45	45	45

$a_1 = 7$	6	7	8	9	10	11	12
6	55	52	52	52	52	52	52
7	50	47	46	45	45	45	45
8	50	46	44	44	44	44	44
9	50	46	43	41	41	41	41
10	50	46	42	41	40	40	40
11	50	46	42	41	40	40	40
12	50	46	42	41	40	40	40

$a_1 = 8$	6	7	8	9	10	11	12
6	55	52	52	52	52	52	52
7	49	46	44	44	44	44	44
8	49	46	43	42	41	41	41
9	49	44	39	38	37	37	37
10	49	43	39	38	37	37	37
11	49	43	39	38	37	35	34
12	49	43	39	38	37	35	34

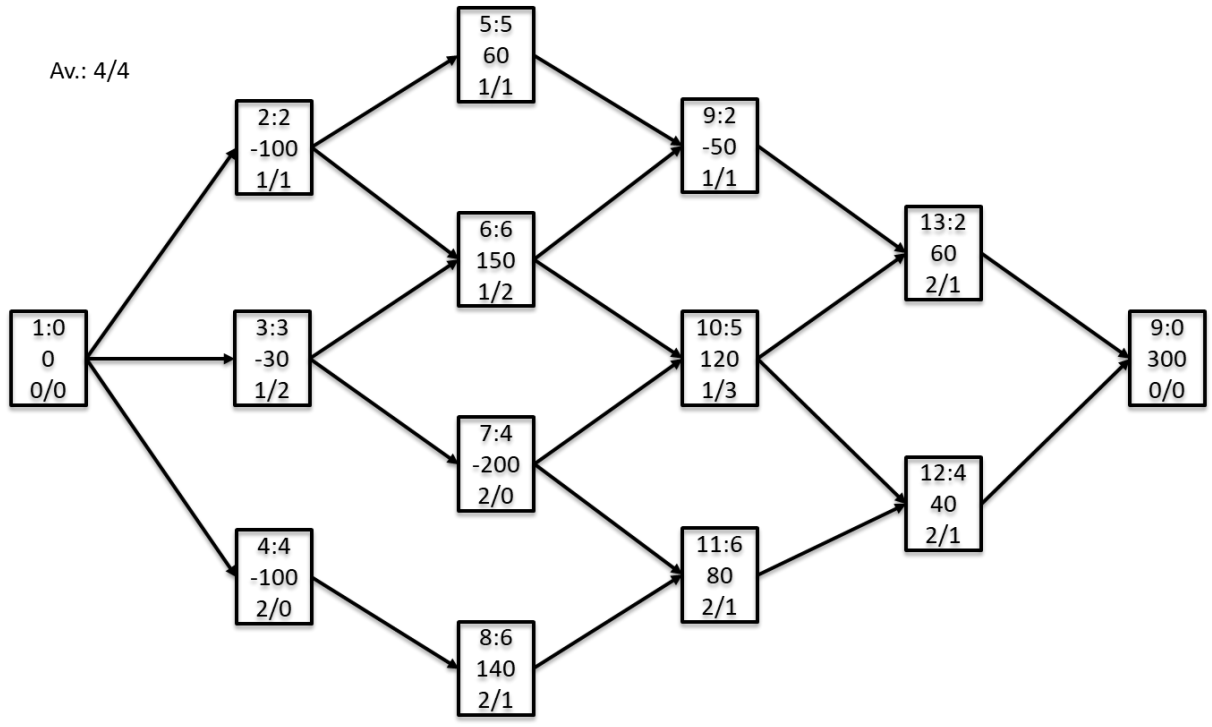
$a_1 = 9$	6	7	8	9	10	11	12
6	55	52	52	52	52	52	52
7	49	46	44	43	43	43	43
8	49	45	42	41	41	41	41
9	49	44	38	37	35	35	35
10	49	43	38	37	34	34	34
11	49	43	38	37	34	34	33
12	49	43	38	37	34	33	32

$a_1 = 10$	6	7	8	9	10	11	12
6	55	52	52	52	52	52	52
7	49	46	44	43	43	43	43
8	49	44	42	41	41	40	40
9	49	41	37	37	34	34	34
10	49	41	37	36	33	33	32
11	49	41	37	36	32	32	31
12	49	41	37	36	32	31	31

$a_1 = 11$	6	7	8	9	10	11	12
6	55	52	52	52	52	52	52
7	49	46	44	43	43	43	43
8	49	44	42	41	41	40	40
9	49	41	37	37	34	34	34
10	49	41	37	36	33	33	32
11	49	41	37	36	32	32	31
12	49	41	37	36	32	31	30

$a_1 = 12$	6	7	8	9	10	11	12
6	55	52	52	52	52	52	52
7	49	46	44	43	43	43	43
8	49	44	42	41	41	40	40
9	49	41	37	37	34	34	34
10	49	41	37	35	33	33	32
11	49	41	37	35	32	31	30
12	49	41	37	35	32	31	30

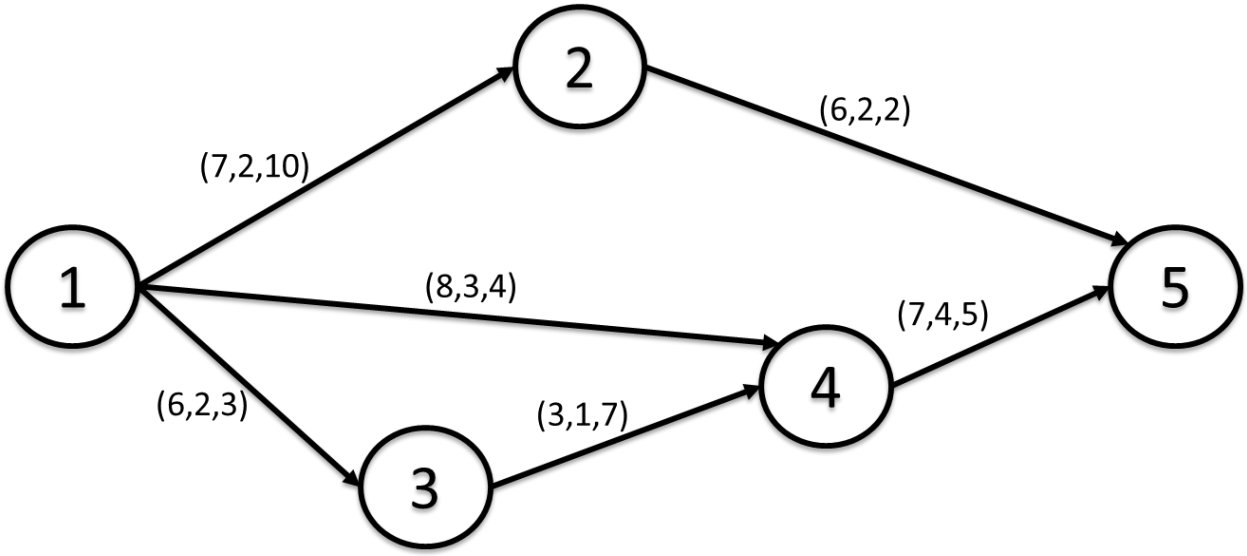
2. Consider the activity-on-node representation of the following problem instance:



Each node first contains the activity number and the duration, while on the next line the net incremental cash flow generated at the completion of the corresponding activity is shown. On the last line, the resource requirements for the two resource types are represented. The project deadline equals 24 periods. The

renewable resources have an availability of 4 and 4 units per period, respectively. The discount rate α amounts to 0.02. Apply an exact procedure for generating a schedule that yields an upper bound on the net present value of the project. Explain your computational steps in complete detail.

3. Consider the activity-on-arc representation of the following problem instance in which for each activity respectively the upper bound on the duration, the lower bound on the duration and the marginal cost of reducing the activity duration by one time unit is given.



Apply the labeling procedure of Fulkerson and Kelley in order to find the cheapest way to reduce the project length to 10 time units (you may stop the procedure as soon as the project length has been reduced to 10 time units or less). For each step, clearly indicate which activities have been crashed. Also indicate at what extra cost the reduction to 10 time units can be obtained and what the optimal durations of the different activities amount to. Explain your computational steps in sufficient detail.