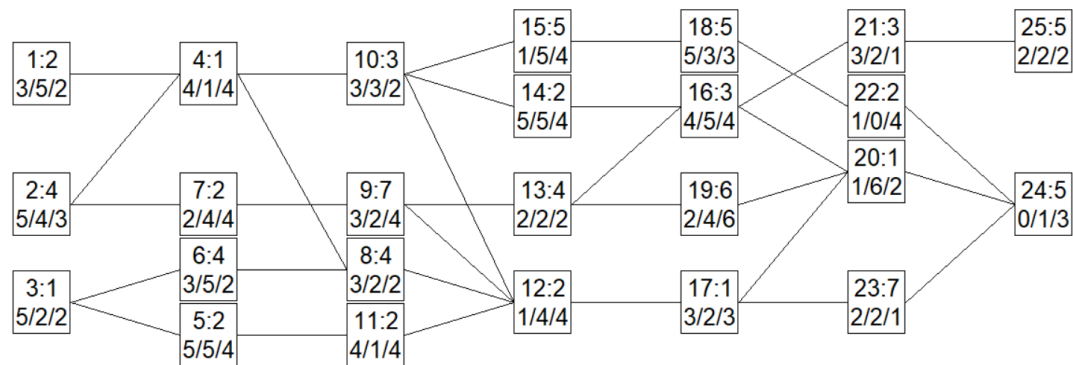


Homework 2

- Using the RESCON software, find the cheapest resource assignment for problem "Pat100.rcp" (to be found on Toledo) given a project deadline of 40 when the unit costs for the different resource availabilities are $c_1 = 4$, $c_2 = 5$ and $c_3 = 7$. 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

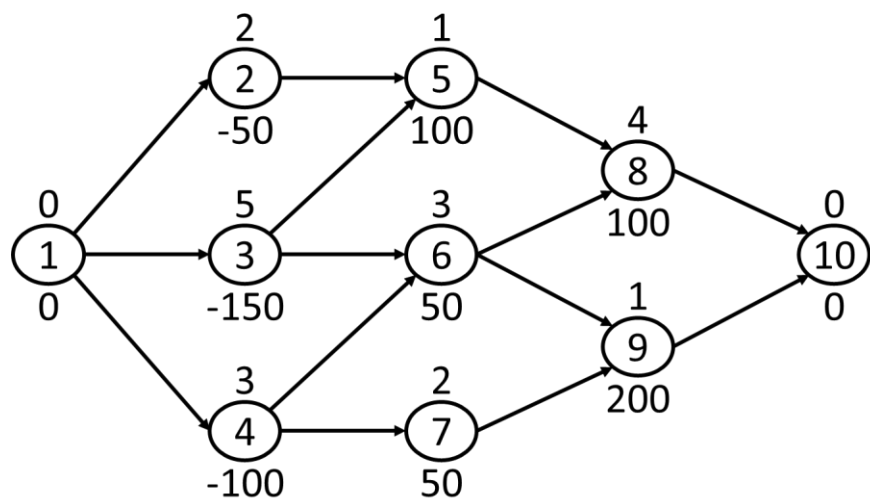
$a_1 = 9$	6	7	8	9	10	11	12
6	55	52	52	52	52	52	52
7	49	46	44	43	43	43	43
8	49	45	42	41	41	41	41
9	49	44	38	37	35	35	35
10	49	43	38	37	34	34	34
11	49	43	38	37	34	34	33
12	49	43	38	37	34	33	32

$a_1 = 10$	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 in which the goal is to maximize the net present value of the project schedule (without considering resource constraints). The durations of the different activities are indicated above the nodes and the cash flows at the completion of the activities are shown below the nodes.

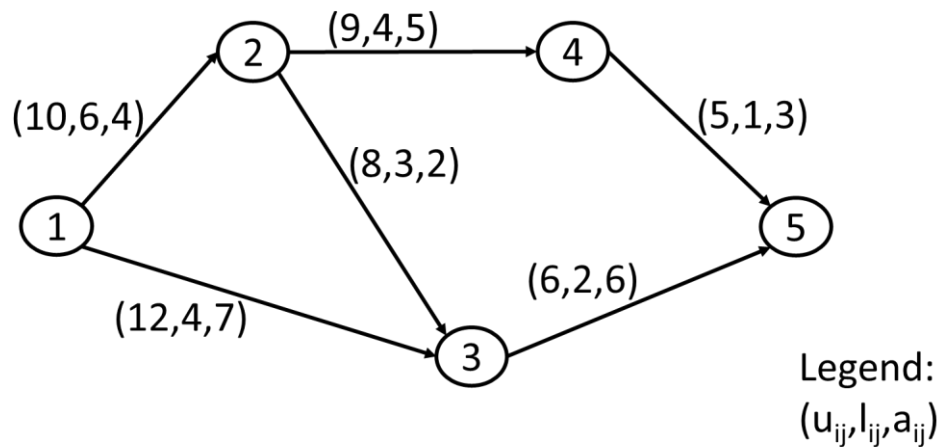


If the project deadline equals 15 time units and the discount rate happens to be 5%, compute the optimal schedule in which the net present value is maximized. Please explain your computational steps in sufficient

detail. In performing your computational steps you may rely on the following computational results for the net present value (the amounts are shown in the columns while the periods are shown in the rows):

0,05	1	50	100	150	200
1	0,951	47,561	95,123	142,684	190,246
2	0,905	45,242	90,484	135,726	180,967
3	0,861	43,035	86,071	129,106	172,142
4	0,819	40,937	81,873	122,810	163,746
5	0,779	38,940	77,880	116,820	155,760
6	0,741	37,041	74,082	111,123	148,164
7	0,705	35,234	70,469	105,703	140,938
8	0,670	33,516	67,032	100,548	134,064
9	0,638	31,881	63,763	95,644	127,526
10	0,607	30,327	60,653	90,980	121,306
11	0,577	28,847	57,695	86,542	115,390
12	0,549	27,441	54,881	82,322	109,762
13	0,522	26,102	52,205	78,307	104,409
14	0,497	24,829	49,659	74,488	99,317
15	0,472	23,618	47,237	70,855	94,473

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 16 time units (you may stop the procedure as soon as the project makespan has been reduced to 16 time units). For each step, clearly indicate which activities have been crashed. Also indicate at what extra cost the reduction to 16 time units can be obtained. Explain your computational steps in sufficient detail.