Network analysis
(Assignment 4)
Project Management and Research Methodologies

Author	Ladislav Šulák
Email	er1281@edu.teicrete.gr
Institute	Technical Educational Institute of Crete

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Exercise 1

(a) Network diagram is depicted in in Figure 1 and it includes all required information, we calculated:

- *forward pass*. It was done from left to the right. The **minimum overall completion time** is 14 weeks. We also added dummy node, which has completion time 0 weeks.
- *backward pass*. This was done by calculating times from right to the left.
- *float* or slack time F. This indicates how much we can increase completion time of a given activity without increasing (changing) the overall project completion time.
- *critical path*. It was achieved by looking which nodes have float value of zero, since it indicates critical activity. Activity 10 is not real, but only dummy one, so we will not consider it as critical. Following acitivies are critical: 2, 4, 7 and 9.

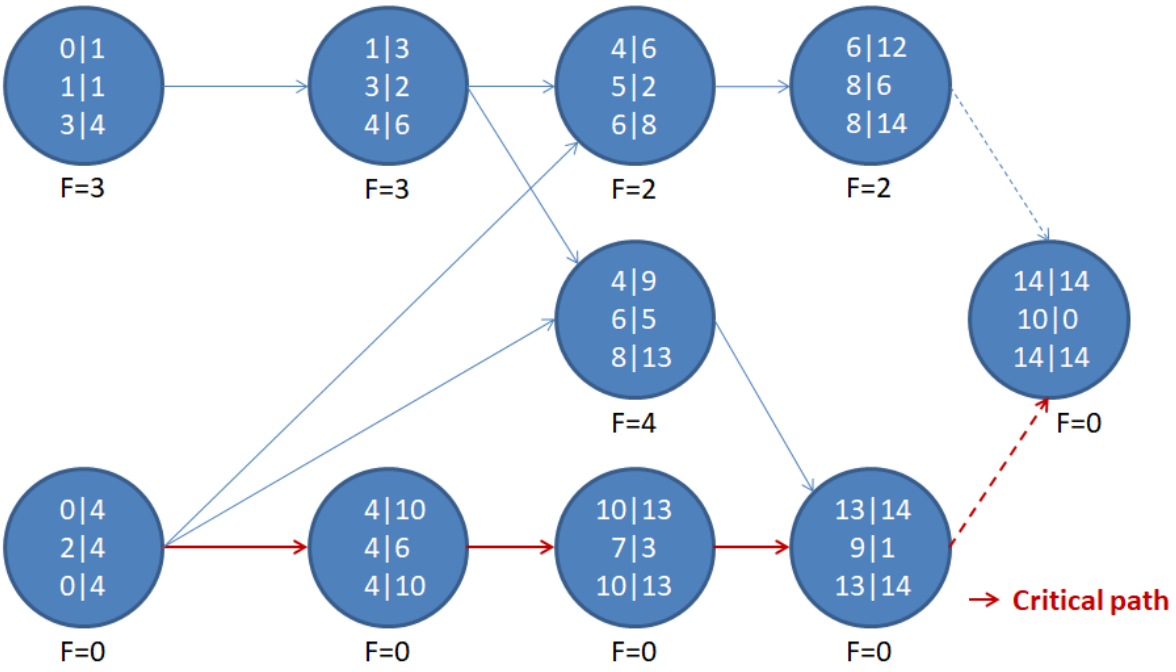

Figure 1: Critical path management network diagram containing values after forward and backward pass as well as float values.

(b) Overall project completion time would be affected in following way:

- activity 6 increased by 2 weeks - **unchanged** since there is space for increasing by 4 weeks (float value) without any changes in overall project completion time.
- activity 8 decreased by 2 weeks - **unchanged** since activity 8 is not the critical one and only such activities are affected by lowering their completion time.

(c) Cutting down completion time of activity 4 (a critical activity) by 3 weeks would have impact on the whole project completion time. If the project completion time will fall by 3 weeks cannot be automatically seen, rather we will provide recalculation of earliest starting and finishing times for the network. We will work with E_i where i is the number of activity:

$E_1 = 0$

$E_2 = 0$

$E_3 = E_1 + T_1 = 1$

$E_4 = E_2 + T_2 = 4$

$E_5 = max(E_3 + T_3, E_2 + T_2) = max(3,4) = 4$

$E_6 = max(E_3 + T_3, E_2 + T_2) = max(3,4) = 4$

$E_7 = E_4 + T_4 = 7$

$E_8 = E_5 + T_5 = 6$

$E_9 = max(E_6 + T_6, E_7 + T_7) = max(9,10) = 10$

$E_10 = max(E_8 + T_8, E_9 + T_9) = max(12,11) = 12$

Critical path has been changed and the overall project completion time has been lowered from 14 weeks to 12 weeks. The changes in earliest times were only in activities 7, 9 and 10.

(d) At the end of 8 weeks, the status of the activities are depicted in Figure 2. We removed all finished activities along with their relationships with the other ones and recalculated earliest times for the network - we performed a forward and backward pass to the given network. According to our calculations, the project should be finished in 7 weeks. Since 8 weeks have already elapsed, the whole project will be completed in 15 weeks. It means that it is delayed by 1 week in comparison to the initial estimation.

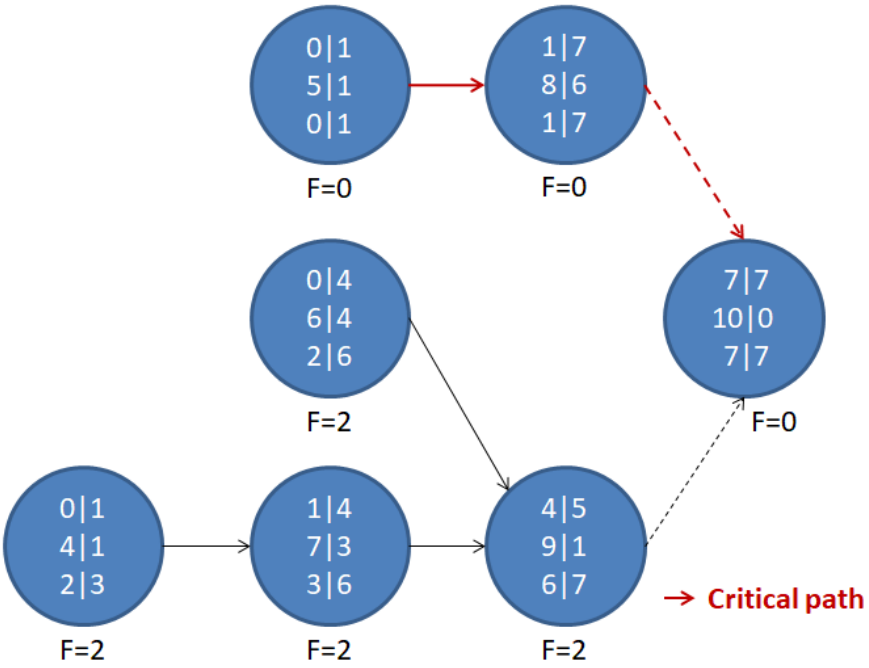

Figure 2: Status of the activities at the end of 8 weeks and recalculation of times and float values.