## MP305 Practical 2020/2021 - Activity Networks

- The `Python` notebook `Activity_Network` that can be accessed via any web browser. See the **MP305 Blackboard** web page for details and instructions.
- Solutions to **all** questions with **(*)** have to be submitted as a pdf document through Blackboard. You must include some text commentary (in Python notebook Markdown cells) to explain your answers to the questions asked.
- This practical is worth 4% of your final grade.

1. Analyse the chemical production problem discussed in class as given in the `Python` notebook `Activity_Network`
2. **(*)** Find the critical path and the minimal completion time for the following assembly problem with 10 activities (A-J):

   **Activity A** precedes activity J and the completion time is 7.

   **Activity B** precedes activity J and the completion time is 7.

   **Activity C** precedes activity J and the completion time is 7.

   **Activity D** precedes activities C, E, F and J and the completion time is 2.

   **Activity E** precedes activities C, H, I and J and the completion time is 3.

   **Activity F** precedes activities G, H and I and the completion time is 2.

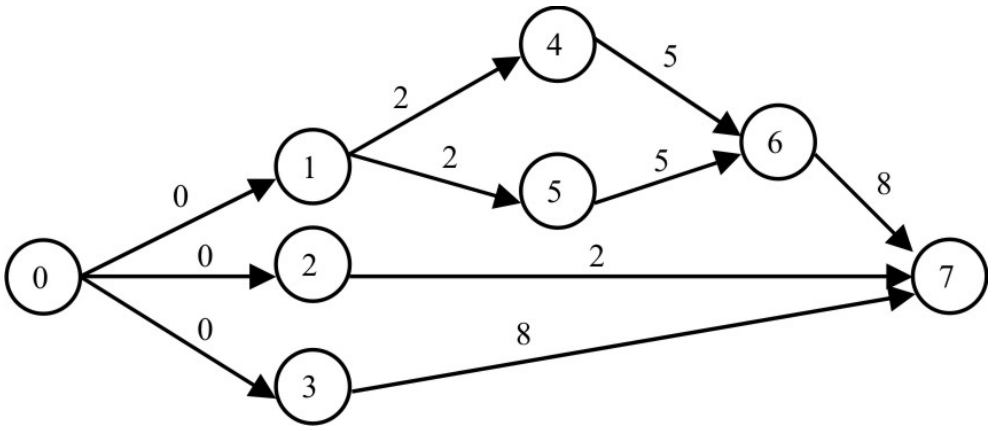
   **Activity G** precedes activities H and I and the completion time is 2.

   **Activity H** precedes Finish and the completion time is 8.

   **Activity I** precedes Finish and the completion time is 8.

   **Activity J** precedes Finish and the completion time is 18.

3. Investigate the scheduling of 2 or 3 workers to the example




discussed in class using the critical path and protection scheduling using the Python functions `CritSchedule(G,T,Nw)`and `ProtSchedule(G,T,Nw)`. With the earliest and latest starting times found verify the scheduling found by hand.

4. **(*)** A large computer program consists of a number of modules (or subroutines) $M_1, M_2, M_3, M_4, M_5, M_6, M_7$ and $M_8$. Each module $M_i$ takes a time $T_i$ (in seconds) to complete and their completion depend of some preceding modules as follows:

| Module | $M_1$ | $M_2$ | $M_3$ | $M_4$ | $M_5$ | $M_6$ | $M_7$ | $M_8$ |
|---|---|---|---|---|---|---|---|---|
| $T_i$ | 2 | 2 | 3 | 2 | 2 | 6 | 3 | 4 |
| Preceding | none | none | $M_1$ | $M_1, M_2$ | $M_1, M_2$ | $M_3, M_4, M_5$ | $M_3, M_4, M_5$ | $M_3, M_7$ |

   (a) Construct the activity network for this system with standard labeling.

   (b) Find the critical path minimal completion time assuming that a sufficient number of parallel processors are available. What are the earliest and latest starting times for each module?

   (c) Find the minimal completion time assuming that only **two** parallel processors are available using the critical path or protection scheme scheduling strategies. What is the average computing time per processor?

   (d) A programmer realizes that part of **either** module $M_3$ **or** $M_4$ can placed in module $M_6$ at a saving of 1 minute in for $T_3$ **or** $T_4$ but at the expense of 1 minute further in $T_6$. What would you recommend for maximum efficiency given that you have only two parallel processors?