MP305 Practical 2017/2018 - Activity Networks II

The Maple procedures that perform the activity network algorithms are found by opening up the Maple worksheet `cripath2.mw`

This file may be downloaded from the **MP305 Blackboard** web page.

An explanation is given there of all the procedures used. A project consists of `N` activities given by a set `Act:={"A","B",...}`, with completion times given by a table `Time` with entries such as `Time["A"]:=3` etc and precedence relations given by a table `Prec` with entries such as `Prec["A"]:={}` if no preeeding activity or `Prec["A"]:={"B"}` if `"A"` is preceeded by `"B"`.

The procedure `Activity(Act,Time,Prec)` then produces a set, `G`, of arcs `[i,j]` with vertices `i,j` labelled by `0,1,2,...,N+1`, e.g. `G:={[0,1],[1,2],...}`. The START vertex has label `0` and the FINISH vertex has label `N+1`. The completion times for each activity are described by `T`, an array e.g. `T[0]:=0; T[1]:=3;` etc. A graph is also displayed showing the activity network (w/o time labels).

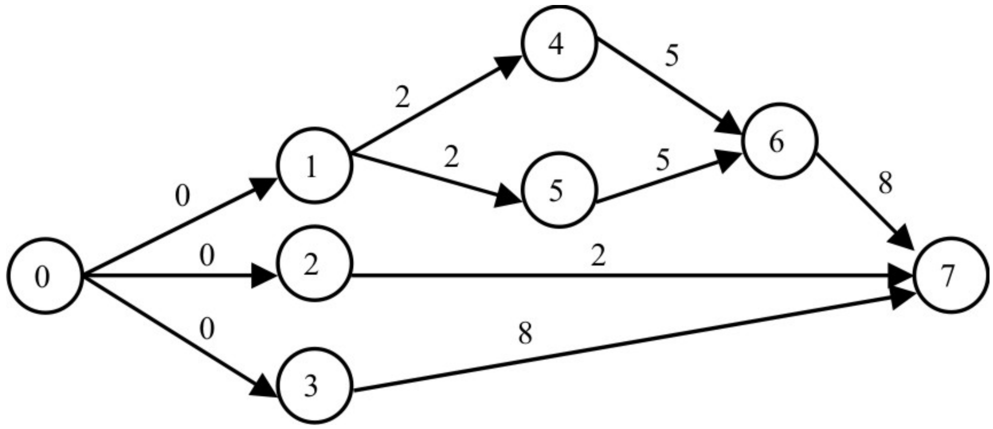
The procedure `CritPath(G,T)` computes the critical path, the minimum project completion time, the earliest and latest starting times and the float for each activity.

The procedure `CritSchedule(G,T,Nw)`implements the Critical Path Schedule for assigning tasks to `Nw` workers. The output describes the assignment of activities to each worker together with a graphical display of the history over time.

The procedure `ProtSchedule(G,T,Nw)` implements the Protection Scheme Schedule for assigning tasks to `Nw` workers. The output describes the assignment of activities to each worker together with a graphical display of the history over time

Notice
Solutions to the questions marked with (*) have to be shown (and explained) to the instructor at the practicals in order to get 4% that count towards the overall mark.

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



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

2. **(*)** Investigate the scheduling of 2 **and** 3 workers to the assembly problem in *Modelling Practical 2017/2018 – Activity Networks I* using the critical path and protection scheduling using the procedures `CritSchedule(G,T,Nw)` and `ProtSchedule(G,T,Nw)`. With the earliest and latest starting times found verify the scheduling found by hand.

3. **(*)** 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?