Problem Set 1

Mark Xavier (xaviem01)

January 30, 2019

1. Problem 1

Task	T1	T2	T3	T4
Length	12	42	48	54

Processor	P1	P2
Speed	2	3

(a) Characterize tree structures state space problem.

- The **states** are characterized as as either the empty state (no tasks assigned to the any processors) or a partially filled state (some n tasks assigned to m processors). Technically the goal state (the state where all tasks are assigned some processor and the total time taken is less than deadline time D) is also a state.
- The **operators** (or operations) are defined as actions that assign a given task to a processor, such that the time taken by that processor to finish the task plus the sum of times for all other tasks assigned to that processor do not take time D or more to finish.
  In other words, assuming p_i to be some processor in the set of processors P, and t_j to be some task in the set of tasks T, and defining $t_j \in p_i$ as task t_j being assigned to p_i, the operation of assigning $t_j \in p_i$ is only allowed if the following inequality is maintained:

  $$(\sum_{p \in P} \sum_{t \in p} t.length/p.speed) < D$$

  Where D is the deadline time.
- The **branching factor** is 2, since at each step we assign a given task to one of the two processors.
- The **depth of the goal node** is known initially in some cases where a solution exists. If a solution exists, then all tasks are assigned a processor, and therefore the depth of the goal node is 4, since there are 4 edges from the goal node to the root node. Of course if no solution exists, then the goal node does not exist and it's depth is undefined.

(b) State space with depth-first search:

```
0 --- T1 to P1 (6) --- T2 to P1 (27) --- T3 to P1 (51 - fail)
|-- T3 to P2 (27,16) --- T4 to P2 (27, 34 - fail)
```