Problem Set 1

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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** may not be known initially for some arbitrary numbers of processors and tasks, as they constricting condition of *task.length/processor.speed* being less than D overall needs to be maintained, and will depend on the varying speeds and lengths encountered. All tasks may be assigned to a single processor, and yet another solution for the same case may have a 50-50 split between two processors or more.

(b) State space with depth-first search:

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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)
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