ECE 153a/253
Homework 5

Due: Wed. Nov. 9, 2010

Reading: Papers on Website

Problems:

1. Scheduling is the simple process of time-ordering activities to optimize some criteria. It is surprising how complex scheduling can become, even for minimal time, unit resource schedules. Consider the following:

4 people need to cross a bridge at night, the bridge can only carry 2 people at a time. To avoid falling off the bridge, one of the people crossing must carry the single flashlight. Because of their ages, the four people need different times to cross, A needs 2 minutes, B needs 3 minutes, C needs 8 minutes and D needs 10 minutes. All start on one side, with the flashlight. Find a schedule that minimizes the total time to get all people across.

a. What is the minimum time?

b. Is the schedule unique? (i.e. is there only one way to do it?)

2. Below is an example of a continuous process scheduling:

A person of one of the 4 types (A:2, B:3, C:8, D:10) arrives periodically every p minutes. There can be at most 4 people waiting to cross the bridge, however, since it is now daytime you do not need the flashlight. It is still the case that only 2 people may cross at a time, however, they do not need to start at the same time -- so long as only 2 are ever on the bridge simultaneously.

a. What is the smallest period p if the people arrive sequentially with the repeating sequence a,b,c,d,a,b,...

b. What is the smallest period if the people arrive in a random sequence?

c. If the probability of any given type is 1/4 and you attempt to cut the period found in part b by 1 minute, estimate how many people can cross before you have too many waiting. Start with no people waiting at time t=0. (Here you might wish to write a small c-based simulator...)

3. List Scheduling (outlined in the Landscov paper) works by keeping a list of possible new things free to schedule (i.e. not waiting for dependencies) and uses greedy selection to fill up the free resources with items from this list. It selects items on the basis of locally optimizing some cost metric -- such as maximizing resource use. After filling the current time slot, it then recalculates which items are free (items which finished will remove dependencies and thus potentially add members to the free list). It then finds which resources are now available and repeats the process till all items have been completed.

Describe how to apply list scheduling to problem 2 above -- hint, you must decide what to do each p minutes and do not have any prior knowledge of the future arrivals. Does list scheduling maximize the utilization of the bridge? If not, why not?