CS 1510 Homework 5

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September 6, 2018

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a

SJF is not optimal on the following input I:
$J_1 = (0, 2)$
$J_2 = (1, 2)$
For each time t:

1. Run J_1 (it is the only choice)
2. Run J_2 (arbitrarily, since J_1 and J_2 are the same size.)
3. Run J_2 (arbitrarily). J_2 is completed now, so $C_2 = 3$
4. Run J_1 (it is the only choice). J_1 is completed now, so $C_1 = 4$

The total completion time for $SJF(I)$ is $C_1 + C_2 = 4 + 3 = 7$
But a more optimal solution $opt(I)$ exists. For each time t:

1. Run J_1
2. Run J_1. J_1 is now finished, so $C_1 = 2$.
3. Run J_2.
4. Run J_2. J_2 is now finished, so $C_2 = 4$.

The total completion time for $opt(I)$ is $C_1 + C_2 = 2 + 4 = 6$
$SJF(I)$ is not optimal therefore SJF is incorrect.

b

This proof does not consider the possibility of job j completing between times t and u. If this were the case, and j was initially scheduled to complete before time u, moving it back to u will increase its completion time, making its output not optimal.

c

Assume that A, the algorithm that implements $SRPT$, is incorrect and has some input I that makes it give the incorrect output. Define $Opt(I)$ to be the correct output that agrees with $A(I)$, the output from A on I, for the most steps. Also define the first "step", or time interval that $A(I)$ and $Opt(I)$ disagree, to be t. At time t, say that $A(I)$ schedules job J_A with tuple (r_A, x_A), and $Opt(I)$ schedules job J_O with tuple (r_O, x_O). We can construct $Opt'(I)$ by simply swapping J_O with the next instance of $Opt(I)$ scheduling J_A, say at time u.
$Opt'(I)$ clearly agrees with $A(I)$ for one more step, as it now also schedules J_A at time t. The problem addressed in part b of this problem can also be disproven here. We know that J_A has a shorter time left until completion than J_O, because of the definition of A. Thus, if J_O were to complete between times t and u, we could simply swap the entirety of J_A into the spots that J_O is ran, and have it complete even earlier, lowering the total completion time. The increased completion time added by having to shift J_O down would be less than the decreased time from completing J_A earlier, because J_O could also be scheduled into the additional slots that J_A does not need.

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