

CSCI 460: Operating Systems—Assignment 3 (8 marks)

This assignment is on priority inversion (page 458-460), well, a simplified version of it. You could use any of the common languages C, C++, Java, Python, etc. Assume the following:

a. There are three kinds of jobs with priorities $P(T_1) = 3$, $P(T_2) = 2$ and $P(T_3) = 1$. A job with a higher priority means it can preempt another one with a lower priority immediately, except that T_1 cannot preempt T_3 as they share a common device.

b. T_1 shares a small buffer of length 3 with T_3 , with an initial value of $\langle 0, 0, 0 \rangle$ at time 0. When T_1 gets hold of it, it changes the content to $\langle 1, 1, 1 \rangle$ and print out a new line: T_1111T_1 . When T_3 gets hold of it, it changes the content to $\langle 3, 3, 3 \rangle$ and prints out a new line: T_3333T_3 . Each of T_1 and T_3 takes 3ms (1ms = 1 slice) to run, and you can assume that the enforcement of mutex, etc, takes no time.

c. T_2 shares nothing with T_1 and T_3 . When T_2 runs to completion with no interruption, it prints out a new line: $T_2NNNNNNNNNT_2$, where ‘N’ means “normal”. Each T_2 takes 10ms to run. When T_1 preempts T_2 , T_2 will print out the number of N’s according to the actual time it has run (in the number of slices). For instance, T_2 runs at time 0, then there is a request at time 6 for T_1 , then T_2 should print out: $T_2NNNNNT_2$. Then, T_1 takes over at time 6. Same rule applies to T_3 , when it is preempted by T_2 .

d. The input sequence of jobs are in the form $\langle arrival_time, j \rangle$, where $j = 1, 2, 3$ is the index for T_j . When you have a sequence of three inputs: $\langle 1, 1 \rangle, \langle 3, 2 \rangle, \langle 6, 3 \rangle$, the output should be like:

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time 1, T1111T1.  
time 4, T2NNNNNNNNNT2.  
time 14, T33333T3.
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(1) To make the debugging easier, you could use random sequences of at most 10 job requests. Implement the version with priority inversion, i.e., a higher priority job can always interrupt a lower priority job (except that T_1 cannot preempt T_3 as they share a common buffer). Print out one scenario when the priority inversion occurs.

(2) For the following sequence of input print out your output: $\langle 1, 3 \rangle, \langle 3, 2 \rangle, \langle 6, 3 \rangle, \langle 8, 1 \rangle, \langle 10, 2 \rangle, \langle 12, 3 \rangle, \langle 26, 1 \rangle$.

Date Due: 11:30pm on Thursday, November 30, 2017 (on or before 11:30pm, Nov 30, 2017). Load your source code and output as two separate files on D2L in the folder **Assignment 3**, preferably in the form of **family_name – 3.java** and **family_name – 3.output** (assuming that you are using Java).