Course SE 350

Final Exam

April 20, 2010

1. What material did you **mainly** use to prepare for the quiz? Pick only one; any selection will get you full points. *[2p]*

   □Printed book □Electronic book □Own notes on slides □Abstain

2. Draw the seven state diagram for process state transitions. Explain the nature of all transitions that leave the Running state in one sentence each. *[11p]*

3. Explain the term *race condition*. Provide a pseudo code example and an execution trace that demonstrates the problem. *[10p]*

4. Explain the difference between logical address, relative address, and physical address. *[9p]*

5. The I/O subsystem receives the following track read requests: 193, 91, 139, 163, 24, 166, 144, 69, and 91. The read head is currently located at track 101. Schedule the I/O using SSTF. Show the access behaviour in a figure with time on the x-axis and the track number on the y-axis. The disk's read head moves 3 tracks per millimetre on the x-axis. Write down how much many millimetres have passed between the initial and the last read request on the x-axis. *[20p]*

6. Two parents and their three children are standing in front of a cookie dispenser. The parents feed the machine with one cent coins. The machine uses the coins to make cookies, and dispenses them once the deposited amount exceeds two cents. The children continuously stares at the cookie machine and whenever it sees a cookie, then they will grab and eat it.

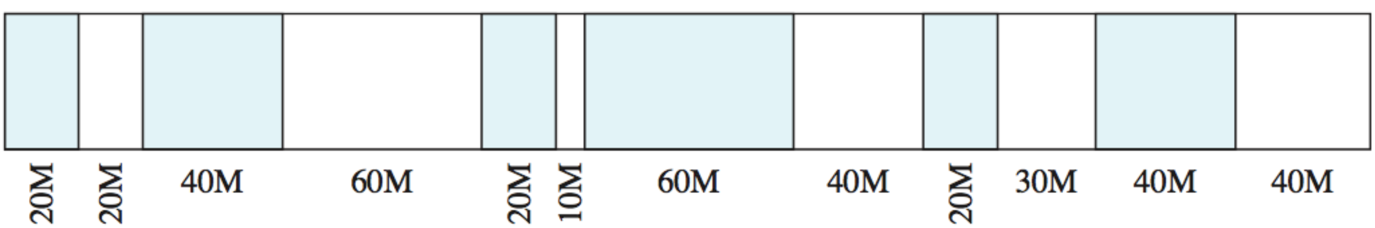
   Available functions include: Parents use PrepareCoin() to prepare the next coin to be inserted and InsertCoin() to deposit a one cent coin in the machine. The machine uses PrepareCookie() to bake the next cookie and DispenseCookie() to dispense the baked cookie. The kids use GrabCookie() to take the dispensed cookie and EatCookie() to eat the taken cookie. Assume that the usual functions mentioned in the book such as parbegin(…) are available. Assume that PrepareCoin() takes a random amount of time, often much longer than all the other functions. The cookie machine accepts new coins as it produces the cookie (i.e., parent can execute InsertCoin() while the machine executes DispenseCookie()).

Make sure that (a) the kids take/eat only when a cookie is available, (b) the machine only dispenses cookies when enough funds have been deposited, (c) the parents never try to insert coins simultaneously, (d) the kids don't touch the dispenser unless the machine finished dispensing the cookie, (e) only one kid at a time grabs a cookie. The world is an unfair place, so don't bother with fairness when giving cookies to the kids.

Write the pseudo-code program that controls concurrency using semaphores for above mentioned scenario and explain the program. Don't use busy waiting. *[25p]*

7. Assume a set of processes with periodic execution (i.e., the processes execute for their service time and restart again after the period has passed) on a single-processor machine.
   - Define four such processes with their name, periods, and service times. The total system utilization must be greater than 0.55, each process must have a system utilization greater than 0.1, no two process periods should be the same. *Hint: remember that you have to draw the schedule up to the least common multiple of the periods, so choose them wisely.* *[4p]*
   - Use rate-monotonic (RM) scheduling to define the processes' priority levels and draw the resulting schedule. *[16p]*

8. A dynamic partitioning scheme is being used, and the following is the memory configuration at a given point in time:



The shaded areas are allocated blocks; the white areas are free blocks. The next three memory requests are for 40M, 20M, and 10M. Indicate the starting address for each of the three blocks using the following placement algorithms:

- First fit *[6p]*
- Best fit *[6p]*
- Next fit (assuming that the most recently added block is at the beginning of the memory) *[6p]*

End of quiz. Total points: 115