Course ECE354

Midterm

June 19, 2009

1. Create an example with at least four processes and five resources in which the Banker's algorithm determines an unsafe state. Describe the initial state, the resource request, and show why it leads to an unsafe state. *[20p]*

2. Program a system with the four robots A, B, C, and D: Two robots, A and B, produce bricks and stack them in front of them. Each producing robot has exactly one stack. Each stack can hold up to four bricks before it topples over, and obviously only one robot can operate on one stack at a time. Two robots, C and D, consume bricks from the stack. All consuming robots consume from the stacks in a round robin fashion (e.g., consume from A, B, A, B, ...).

   Available functions for handling bricks: *produce()* produces a new brick. *put(stackid)* puts the produced brick onto the stack *stackid*. *consume()* uses a brick. *get(stackid)* gets a brick from the stack *stackid*. Assume that the usual functions mentioned in the book such as *parbegin(...)* are available.

   Hint: First assume only one producing and one consuming robot and then extend your solution.

   - Write a well performing pseudocode solution for all robots for this scenario and be careful about the concurrency control of the stacks. Use whatever concurrency control mechanism mentioned in the lecture you want except busy waiting. Explain your program. *[30p]*
   - Explain how the program changes with n robots consuming bricks and stacks that support m bricks before toppling over. *[4p]*

3. Explain three reasons why a process may leave the ready queue. *[6p]*

4. Choose three combinations of blocking/non-blocking send/receive and explain one sensible use of each. *[9p]*

5. Explain the term deadlock, explain the prerequisites for a system to deadlock, and provide a code example with comments that demonstrates a deadlock. *[15p]*

6. Explain the steps involved when spawning a new process with the Unix system call *fork()*. Minimum six distinctive steps for full points. *[6p]*

7. Explain how the following situation can occur: A process consists of two threads. Thread A is in the ready state. Thread B is in the running state. The process itself is in the blocked state. *[5p]*

8. Explain the term spinlock and describe one advantage and one disadvantage. *[5p]*

End of midterm. Total points: 100

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Midterm guide: The exam consists of 8 questions listed on one page. The exam totals 100 points. The exam duration is 80 minutes. Make sure you put your name and ID on the exam booklet and that you personally give your midterm to the proctor collecting the exam so it is not lost.

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