Course SE350

Midterm

Feb 26, 2010

1. Consider a system with two producer processes, A and B, and two consumer processes, C and D. Processes A and B produce items and place them in one of the two stacks—S_1 with capacity of five and S_2 with the capacity of ten—in a round robin fashion (i.e., A will use S_1, S_2, S_1, S_2, ...). Process C consumes only from S_1 and Process D only consumes from S_2. Please note that only one process can operate on a given stack at a time.

   Assume the following functions are available:

   - produce(): produces a new item
   - put(stackid:) puts the produced item onto the stack designated by *stackid*
   - consume(): uses an item
   - get(stackid): gets a brick from the stack designated by stackid

   Also, assume that the usual functions mentioned in the book such as parbegin() are available.

   (a) Write a solution to this problem as a well-performing pseudo-code using a concurrency control mechanism of your choice that does not involve busy waiting. Briefly describe the operation logic of your code. *[25p]*

   (b) Explain how your code would change (if any) to accommodate m producer processes and stacks of size k and l, respectively, i.e., S_1 of size k and S_2 of size l. *[10p]*

2. Is it possible to support multi-thread in an operating system without multi-programming? If yes, explain how that would work. If no, explain what prohibits this. Draw a figure to clarify your argument. *[8p]*

3. Explain (1) the general concept of time sharing, (2) its principal objective, (3) why the concept serves the purpose of the objective, and (4) why time sharing was relevant at the time it was invented. One sentence per point. *[8p]*

4. What is external fragmentation in memory systems? Explain the concept and provide an example how it can occur. *[10p]*

5. Explain the difference between a general interrupt and trap in terms of what causes them and how they are used. *[6p]*

6. Explain the concept of *busy waiting*. Provide a pseudo-code example. *[6p]*

7. Explain the microkernel architecture and explain three advantages of this architecture compared to a monolithic kernel. *[9p]*

8. Create a system with at least three processes of which at most two processes deadlock. Show the request matrix (processes × resources), the allocation matrix (processes × resources), the resource vector, and the available vector. Then execute a deadlock detection algorithm (if it differs from the one discussed in class, please explain your algorithm; the algorithm must be universally applicable to detect deadlocks with the given data structures) and show the individual steps until the deadlock is detected. *[25p]*

End of midterm. Total points: 107

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Midterm guide: The exam consists of 8 questions listed on one page. The exam totals 107 points. The exam duration is 85 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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