

2010/Spring Operating System PhD Qualifying Exam

Student ID _____ Name _____

1. Consider live migration of virtual machines between different nodes of a local cluster. State three different approaches for the migration. Compare the pros and cons of those three approaches. (10pts)
2. Compare event-based, thread-based, and VM-based approaches for sensor operating systems. (10pts)
3. State the advantages and shortcomings (at least three, respectively) of Tiny OS as a sensor operating system (10pts)
4. In memory management, page-based schemes provides many benefits. One of the page-based schemes is to use the inverted page table (IPT). What are the advantages and disadvantages of using IPT? (5 pts)
5. What is thrashing? What is working set? (5 points)
6. Suppose you are working for a startup (venture) company that aims to develop a website called “I-can-answer-whatever-questions”. The key idea of this website is that users give any questions to this website, and this website will give correct answers to the questions. As a first step, this website is designed to answer the following questions. (20 pts)
 - A. Users specify stock names, and the website gives their current stock prices (this current stock price should be given immediately. Otherwise, it would be an “old” stock price, rather than the “current” stock price)?
 - B. Users specify sports games (i.e., a baseball game in the Korea Series), and the website gives the current game scores of the games (it should be also given immediately).
 - C. Users can specify very heavy mathematical formula (i.e., complex matrix operations), and the website calculates the formula (which can take a long time) and shows the result.
7. Suppose you are asked to develop a web server architecture (i.e., threading architecture). Naturally, it is desirable to create a thread upon receiving every request (A, B, or C) and to let the thread take care of the corresponding request. In order to provide very fast answers to user requests of type A & B, you can assume that all the current stock prices and game scores are always stored in the main memory (by some magical techniques) so as to avoid the time to read such data from disks.
 - A. In dealing with multiple threads, one of the key issues is how to schedule them. How would you design a scheduling algorithm for such threads? And justify your design. (10 pts)

- B. Another important issue in multi-threading systems is what kind of threading implementation approach is used. In this case, how would you design the threading implementation scheme for this case? You can choose either 1:1, N:1, or M:N (user-kernel) threading model. And justify your design. (10 pts)
8. Describe a log structured file system and explain what type of file access patterns is a log structured file system designed to handle. (10pts)
9. Compare and contrast user-level threads and kernel-level threads (10pts)