University of Alabama in Huntsville - CPE 454/534 Final Exam Dec. 3, 2015

Grad students answer 100 points; Undergraduate students answer 80

NAME \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ GRADE \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. (5 points) \_\_\_\_\_We discussed the bell-lapadula confidentiality model of database security. Describe this model and give an example application of it might be used.
2. (5 points)\_\_\_\_\_We discussed the biba integrity model of for database systems. Describe this model and give an example application where it might be used.
3. 5 points) \_\_\_\_\_We discussed the use of public key cryptosystems in class. Explain what they are.
4. (5 points) \_\_\_\_\_We discussed using public key cryptosystems in class for a confidential exchange of data between me and my stockbroker. Explain how public key cryptosystem was used to ensure privacy, non-repudiation, and defense against a replay attack.
5. (5 points) \_\_\_\_\_Unix (Linix) and windows for the most part use an antiquated system of protection for files. Describe what that system is.
6. (5 points) \_\_\_\_\_SELinux offers a better method for protection called access control lists. Explain what they are and explain why they are not in more common use.
7. (5 points) \_\_\_\_\_We discussed several methods of improving the common login procedure which uses userids and passwords. Describe three of them
8. (5 points) \_\_\_\_\_The working set model is a model of what?
9. (5 points) \_\_\_\_\_How is the working set computed?
10. (5 points) Consider a memory system with a cache access time of 10ns and a memory access time of 110ns – assume the memory access time includes the time to check the cache. If the effective access time is 10% greater than the cache access time, what is the hit ratio H? Show your work.

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11 (10 points) . True/False. Circle the appropriate choice on this sheet. If you are just guessing, explain your answer

(1 point) \_\_\_\_\_(a) T F DMA is a mechanism for allowing an I/O device to transfer data to and from memory without involving the CPU in the transfer.

(1 point) \_\_\_\_\_ (b) T F Memory mapped I/O determines how the pages of an I/O-bound process are mapped to page frames.

(1 point) \_\_\_\_\_((c) T F The root directory of a partition in a Unix system is named “/”.

(1 point) \_\_\_\_\_(d) T F There is only one MBR (master boot record) on a disk drive, but there could be several boot sectors.

(1 point)\_\_\_\_\_\_(e) T F A context switch from one process to another can be accomplished without executing OS code in kernel mode.

(1 point) \_\_\_\_\_(f) T F An advantage of implementing threads in user space is that they don’t incur the overhead of having the OS schedule their execution.

(1 point) \_\_\_\_\_ (g) T F Deadlock can never occur if no process is allowed to hold a resource while requesting another resource.

(1 point) \_\_\_\_\_(h) T F In round robin scheduling, it is advantageous to give each I/O bound process a longer quantum than each CPU-bound process (since this has the effect of giving the I/O bound process a higher priority

(1 point) \_\_\_\_\_(i) T F For machines with 32-bit addresses (i.e. a 4GB address space), since 4GB physical memories are common and cheap, virtual memory is really no longer needed.

(1 point) \_\_\_\_\_ (j) T F A TLB miss could occur even though the requested page was in memory.

1. (5 points) \_\_\_\_\_Suppose we had a 32 bit virtual address space computer and it had pages of size 1k (10 bits). We are presented with two options for page tables. Option 1 is a three level page table indexed by fields of 10 10 and 2 bits respectively and option two is a three level page table indexed by fields of 2 10 and 10 bits respectively. Arguing based entirely on the size of the page tables, which option is best for really small programs and which option is good for really large programs. Show your work.
2. (5 points) Suppose you are doing anti-virus and worm software development which involves working with live software viruses and worms.. Would you be safer using a type I or type II hypervisor to isolate your potentially infected system? Justify your answer.
3. (5 points) In the second exam we created a sparse file. 1- What is a sparse file and 2- give an example of it’s use
4. (5 points) In the class we discussed synchronization algorithm called strict alternation. Describe TWO deficiencies with this mechanism of synchronization
5. (5 points)\_\_\_\_\_Suppose you had a computer with two processors each containing 4 cores. We recommended restarting a process on the same core it last ran on each time it is scheduled if possible. Why is that a good recommendation Explain your answer
6. (5 points)\_\_\_\_\_True or False As translation lookaside buffers get larger and larger, will we reach a point where page tables (multilevel or inverted) will no longer be needed. Explain your answer
7. (5 points) \_\_\_\_\_We talked about in class defragmenting disk drives. What are two reasons we no longer have to do defragmentation as we used to.
8. (5 points) \_\_\_\_\_ Suppose we have a file system with an inode structure. Assume all blocks are 1024 bytes and the inode has 10 direct 1 1st level indirect, 1 2nd level indirect and 1 3rd level indirect. Identify the inode entry for byte 0x5,000,000 (you may use byte 5,000,000 decimal if it helps your computation)
9. (5 points) \_\_\_\_\_ In many computer situations we have more devices then interrupt levels. How is this handled in modern computers.
10. (5 points) \_\_\_\_\_Solid state disk drives suffer from a problem of wearing out the memory cells each time it is used. To reduce, but not mitigate this problem wear leveling is used to continuously move blocks on a solid state disk around each time they are written. Both computers and disk drives now have large ram caches (tens of megabytes at least). Would we be wise to keep writes in ram cache as much as possible and only write the data to the solid state memory cells at the last possible moment. Explain your answer
11. (5 points) \_\_\_\_\_ Hypervisors allow users to have multiple virtual machines running on a single computer.
12. Would running a sacrificial virtual machine running windows which was presented to outside attackers, while keeping the real virtual machines running the real work hidden significantly reduce the problems of internet security. Explain your answer.
13. Would running type I or type II hypervisors be more secure in this situation
14. (10points) \_\_\_\_\_ TAKE HOME QUESTION- DUE SATURDAY DEC 5, 2015 BY MIDNIGHT

An emerging alternative to virtualization is the use of containers. Read about containers and write a short, half page, essay about what they are and how they compare to virtualmachines.