CS-450 & CS-550*: Operating Systems,*
Sections 1 & 2
Fall 2008: Quiz # 1
ANSWERS

INSTRUCTIONS: (1) Closed book, closed notes (but open mind), ***NO*** calculators allowed.
(2) For each question, **circle** the identifying letter next to the choice corresponding to your answer, or fill in the blank, as appropriate.*
(3) You will not get credit for your grade unless you sign the Honor Code declaration on the back of this page(this is a JMU requirement).
(4) You must also print your name legibly ***on the back of this page sheet***, so that I know who you are, and also write the **last four digits only** of your JMU ID number in the indicated location on the back of the page.
(5) For any questions requiring calculation, you must show all your work. If you perform your calculation on sheet(s) of paper not part of the exam, then you must write your name **legibly** on all such sheets and hand them in together with your exam.

1. System **A** contains seven processors, of which one is dedicated full-time to running the OS, while the remaining six processors run user-owned applications processes. Which processing environments can possibly be applicable to this system?

   Answer: **f,** because **a, c,** and **d** are applicable to this system, but not **b.** *1 pt*

   a. Hard Real-Time
   b. Symmetric Multi-Processor
   c. Asymmetric Multi-Processor
   d. Batch
   e. all of the above
   f. more than one, but **not** all, of the above

2. A compiled program has become corrupted; by means of a one-bit error in the stored program, an unprivileged machine instruction has been replaced by a privileged instruction executable only in kernel mode. When a process is executing this corrupted program, what happens when the erroneous instruction is encountered?

   Answer: **c,** because when operating in User mode, a kernel-mode instruction is treated as an illegal instruction. *2 pts*

   a. The processor automatically switches to Kernel Mode so that the instruction can be executed, and then switches back to User Mode following execution of the wayward instruction.
   b. The processor ignores the corrupted instruction, since it cannot execute it in its current User Mode, and proceeds to execute the next instruction following.
   c. The currently running process is aborted, and a different process is dispatched to the processor.
   d. The system crashes and must be rebooted.
   e. none of the above

3. Which option in the command line invoking the **`man`** utility causes it to display the pages for **every** section of the manual that has an entry for the particular utility whose name has been specified in the **`man`** command?

   Answer: Choice **a** (that is, "**-a**", which displays the appropriate pates in **a**ll sections of the manual) *1 pt*

   a. **–a**
   b. –A
   c. –s
   d. **–S**
   e. more than one of the above
   f. none of the above

4. Consider a computer system that uses virtual memory and that has a physical memory hierarchy as follows: Level I cache with a memory access time of 2 **n**sec and a cache hit rate of 80%; Level II cache with a memory access time of 4 **n**sec and a cache hit rate (for Level I cache misses) of 90% ; RAM with a memory access time of 10 **n**sec and a hit rate (for Level II cache misses) of 98%; and a hard disk with an average access time of 20 **m**sec. What is the average time to access a word? NOTE: You may use the other side of this page to do your calculations.

   4 pts

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YourSignature

Please **print** your name **legibly:** _____

Calculation: Out of 10,000 memory references, 8,000 (*i.e.,* 80%) are accommodated in the Level I cache, but 2,000 (20%) require resolution at a lower level.

Out of these 2,000, 1,800 (90%) are accommodated via the Level 2 cache, but the remaining 200 (10%) require resolution at a lower level.

Out of these 200 memory references, 196 (98%) are accommodated in the RAM, but the remaining four (2%) cannot be resolved except through disk access.

Thus, we have:

# of Accesses	**Access Time**	**Total Time**
8,000	2 nanoseconds	16,000 nanoseconds
1,800	4 nanoseconds	7,200 nanoseconds
196	10 nanoseconds	1,960 nanoseconds
4	20,000,000 nanoseconds	80,000,000 nanoseconds
10,000		80,025,160 nanoseconds
Average Access Time:		8**,**025**.**160 nanoseconds = 8**.**025160 microseconds

Please write your answer here: Be sure to specify the units of time.	8 μsec (8 microseconds)

5. A *C* program invokes a ***POSIX*** (*i.e.,* a ***UNIX***-like) system call by means of the following source-code statement: **numberOfBytesRead = read(fileDescriptor, &buffer, numberOfBytesToRead);** Under what circumstances might the invocation of this system call result in the return of a value in **numberOfBytesRead** <u>other</u> than **numberOfBytesToRead** ?

Answer: **e,** because <u>both</u> **a** and **c,** but <u>not</u> **b** (and therefore also not **d**) meet the criterion. *2 pts*

a. There does not exist among the files open for the executing process a file whose descriptor corresponds to **fileDescriptor**.
b. The number of bytes remaining in the file as a result of (*i.e.,* <u>after</u>) execution of the system call is fewer than **numberOfBytesToRead** .
c. The number of bytes remaining in the file immediately <u>prior</u> to execution of the system call is fewer than **numberOfBytesToRead** .
d. all of the above
e. more than one, but <u>not</u> all, of the above
f. none of the above