

Name: _____ CompID: _____

For each question, either (a) mark one circle or (b) circle one of T or F for each row. Blank questions will be weighted slightly higher than incorrectly marked questions.

Feel free to write clarifying comments next to any question or option that needs them.

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Information for Q1–Q2 An operating system wants to switch back and forth between processes *A* and *B* once every hundredth of a second.

Question 1 It sets up a timer to generate 100 _____ each second so that it can do the switching.

- traps
- interrupts
- faults
- aborts

Question 2 Switching away from process *B* requires copying the following from *B*'s state into kernel memory so it can be restored when switching back to *B*:

- T F the top-level virtual page table
- T F the set of open files and sockets
- T F the PTBR
- T F the PC
- T F program register contents
- T F all user-mode physical pages
- T F all allocated intermediate page tables

Question 3 Describe the handling of an interrupt by entering letters from the following list on the line. Include only those letters that occur. List them in order, with the first to occur on the left, last on the right.

- A** the processor resumes execution by running the interrupted instruction **Again**
- H** the processor jumps to the exception **Handler**
- N** the processor resumes execution with the **Next** instruction after where it was interrupted
- R** the state of the user process is **Restored**
- S** the state of the user process is **Saved**
- T** the processor consults the exception **Table**

Answer: _____

Information for Q4–Q8 For each of the following network protocols, pick the most specific available answer.

Question 4 DHCP

- provides reliable communication
- provides best-effort (i.e., unreliable) communication
- maps a host name to a numerical address
- is used to obtain a numerical address for a computer

Question 5 DNS

- provides reliable communication
- provides best-effort (i.e., unreliable) communication
- maps a host name to a numerical address
- is used to obtain a numerical address for a computer

Question 6 IP

- provides reliable communication
- provides best-effort (i.e., unreliable) communication
- maps a host name to a numerical address
- is used to obtain a numerical address for a computer

Question 7 TCP

- provides reliable communication
- provides best-effort (i.e., unreliable) communication
- maps a host name to a numerical address
- is used to obtain a numerical address for a computer

Question 8 UDP

- provides reliable communication
- provides best-effort (i.e., unreliable) communication
- maps a host name to a numerical address
- is used to obtain a numerical address for a computer

Question 9 Given the byte stream comprising a TCP/IP packet, which of the following will be found in that packet? Include only those letters that occur. List them in order, with the information in the first byte to the left of that in the second, etc.

A IP Addresses

M Message content

P Port numbers

Answer: _____

Question 10 If the operating system and its associated software have no security flaws, which one of the following is the most correct statement?

- If you can write code to run in kernel mode, you can run that same code as root
- If you can write code to run as root, you can run that same code in kernel mode
- If you can write code to run as root or in kernel mode, you can also do the other
- Because there are no security flaws, programs cannot enter kernel mode
- Because there are no security flaws, programs cannot become root

Question 11 It is **possible** to limit which of the following by user accounts? Note, this should be answered based what can be done given how user accounts and these activities work, not based on what current operating systems commonly do.

T F which system calls may be used

T F which peripheral devices can be accessed

T F which parts of an accessible file can be accessed

T F which instructions can be run

T F which files on an accessible storage device can be accessed

T F how much memory can be malloced

Question 12 Kernel mode can be entered by

T F an interrupt

T F a trap

T F a privileged non-exceptional instruction

T F a non-privileged non-exceptional instruction

T F a fault

Question 13 PA02 created a multi-level page table that resided entirely in user-mode virtual addresses. The pages comprising a real multi-level page table are found

- in virtual memory
- in physical memory
- in a register
- some levels in one of the above, other levels in another

Information for Q14–Q16 Suppose a virtual memory system is configured with

- 5-level page tables (i.e., one more level than the Intel model we discussed in class)
- 10-bit page offsets
- a PTBR storing the address $0x12340000$
- 8-byte PTEs, with 8 flag bits (valid, writeable, etc) in each

Question 14 How many usable bits are in each virtual address?

Answer: _____

Question 15 What is the maximum amount of physical memory this system could be configured to handle? Answer as a power of two, like 2^{48}

Answer: _____

Question 16 What is the smallest virtual address which will map to the same physical page as the virtual address $0x22446688$? Answer in hex.

Answer: _____

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Pledge On my honor as a student, I have neither given nor received assistance on this exam.

Signature