

**COSC 6360**

**QUIZ #5**

**DECEMBER 8, 2017**

**Closed book.** You can have with you one single-sided 8½ by 11 sheet of notes. UH expels cheaters. I reserve the right to read no more than the first four lines of each answer.

1. Explain why Xen is better suited for supporting Linux and FreeBSD virtual machines than virtual machines running Windows or macOS. (10 points)

Xen is better suited to support open operating systems such as Linux and FreeBSD because it requires modifying the kernel of the guest OS and this is much easier to do with an Open OS. (Recall that the port of Windows XP to Xen mentioned in the paper was still "not yet completed.")

2. How does Xen manage the *page tables* of its guest OSes? (20 points)
  - o Hypervisor lets each VM kernel manage their own page tables but do not use them
    - They contain *bogus mappings!*
  - o It maintains instead its own *shadow page tables* with the correct mappings and uses them to handle TLB misses

3. How does Xen take advantage of the x86 four *protection rings*? (10 points)

Xen has the hypervisor run in ring 0, guest operating systems run in ring 0 and all user programs run in ring 3. This setting prevents guest OSes from interfering with the hypervisor and user programs from interfering with both the hypervisor and the guest OSes.

4. What are GFS *shadow masters*? (10 points)

Shadow masters are possibly stale copies of the master that provide read-only access to the file system even when the primary master is down. They are shadows, not mirrors, in that they may lag the primary slightly, typically fractions of a second.

5. What is the purpose of the GFS *operation log*? (10 points)

The operation log of each master records all changes in the file and chunk namespaces, as well as the mapping from files to chunks, thus keeping them persistent.

6. Which mechanism does Tock use to protect the kernel against misbehaving user processes? (10 points)

**Hardware protection:** Tock processes are hardware-isolated concurrent executions of programs, similar to processes in other systems.

This solution allows user-level programs to be written in any language.

7. What are Tock *grants*? (10 points) What is their *purpose*? (10 points)

Tock grants are separate sections of kernel heap located in each process's memory space along with an API to access them. Unlike normal kernel heap allocation, grant allocations for one process do not affect the kernel's ability to allocate for other processes.

As a result, the rest of the system can keep functioning when one process exhausts its grant memory and fails.

8. When DeepXplore manipulates images in order to detect anomalous behaviors, how does it chose the general direction of the changes it applies to them? (10 points)

They try to generate plausible images that trigger as many different neurons as possible in the DL and elicit different answers from different DL's.