CS 524 Introduction to Cloud Computing

Quiz 1

February 21, 2017

Last name:

First name:

Please note:

1) **The quiz is open-book: you may use the text book in a hard copy (your own), but nothing else;**
2) **No talking or sharing of books of pens is allowed;**
3) **You have to respond to each of the seven questions in the shortest way possible, in maximum two or three paragraphs, and never to exceed the space allowed on the page. The CAs have the right to deduct points for irrelevant discussions. If you feel you don't understand the question or don't know the answer, write just this—it is perfectly all right!**

1. **(10 points)** Give one example of each a) SaaS, b) PaaS, and c) IaaS. (Try to think of your own examples rather than the ones that are given in the book.)

2. **(20 points)** Explain the difference between the Trusted Platform Module (TPM) and the Hardware Security Module (HSM). Give one example of the use of the TPM and one example of the use of the HSM.

3. **(10 points)** Explain what it means that an instruction is *not* virtualizable and give an example of such an instruction's behavior. Can you provide an example of an x86 instruction that is not virtualizable?

4. **(20 points)** You are given a machine *M* and a type-1 hypervisor *X.* Let us call this configuration *(M, X).* You can run a virtual machine *V* in this configuration on top of the hypervisor*: (M, X, V).* Is it possible to run *X* on top of *X* so as to obtain *(M, X, X)* and then *(M, X, X, V)?* If not, explain why not. If it is possible, explain how that would work—by drawing a scheme of interrupt processing at each level. For simplicity, assume that *M* has a fully-virtualizable processor.

5. **(10 points)** Explain the problem that the I/O MMU solves. What problems are introduced when using the I/O MMU?

6. (**10 points)** Explain how XEN supports I/O processing in a guest operating systems.

7. (**20 points)** What is the difference between the virtual machine and a container? Provide an example of a situation where you would use a Linux container rather than a virtual machine.