CSCI-GA.3033-015

Virtual Machines

Final Exam

Spring 2014 – May 14th, 2014 (**90 minutes**)

NAME: **ID:**

- This exam contains 8 questions with a total of 20 points in **four pages.**
- The exam is open book/notes.
- If you have to make assumptions to continue solving a problem, state your assumptions clearly.
- You answer on the question sheet. You can use extra white papers if you want.

1. [3 points]We have seen different ways the hardware can help virtual machines. Discuss three different hardware supports for virtualization, showing what it does and how it helps virtual machines.

2. [2 points] What is ABI? When do we use it? What would have happened if we didn't have ABIs?

3. a. [2 points] Can we have the same ISA for the source and target in a process virtual machine? why or why not?

b. [2 points] Can we have the same ISA for the source and target in a co-designed virtual machine? why or why not?

4. [2 points] I can write a C program and compile it on different machines with different ISAs. Will I gain anything if I design a HLL VM for C in a way similar to Java? Justify

5. [1 points] Does a process virtual machine run in user mode or privileged mode? Why is that?

6. [2 points] Suppose, in a process virtual machine, that the page size of the host is double that of the guest. What can the VM do if two consecutive pages of the guest (mapping to a single host page) have two different privileges (e.g. one is read-only while the other is read-write)? State a solution, as well as its pros and cons.

7. [1 point] Given a group of instructions, we divided them into X static basic blocks and Y dynamic basic blocks. Is X always equal to Y? Explain your logic.

8. Give the following code sequence:

```
1. start:  mov eax, 1
2.         mov ebx, 0
3. loop:   add eax, ebx
4.         add ebx, eax
5.         cmp eax, 0
6.         jl end
7.         cmp ebx, 0
8.         jg loop
9.  end:
```

a. [1 point] Determine the dynamic basic blocks

b. [2 points] Draw a flow graph where each node is a dynamic basic block and annotate it with frequency of edges and frequency of blocks.

c. . [2 points] Given the frequencies you found in the question b above, can we combine some blocks into a traces? If yes, which ones [You can show by drawing a new flow graph if you want]? If not, why not?