Solutions for assignment 1

Part 1: OS definitions (1-3 line answers, 5 x 2 points each = 10 points)
1. Operating system
A program that acts as an intermediary between a user of computer and the computer hardware.

2. Kernel
The one program that runs at all times on the computer, and acts as a layer between the hardware and the system call interface.

3. Interrupt
Hopefully, they answer something around the following sentence “An interrupt should be a signal (from hardware device or software program) that causes the operating system to stop and figure out what to do next”.

4. Real-time OS
A real-time OS should guarantee a certain capability (e.g., data process) within a specified time constraints.

5. System call
Programming interfaces to the services offered by the OS.

Part 2: Multiple choice (7 x 2 points each = 14 points)
1. Which one is not the goal of operating system:
   a. Make the computer system convenient to use
   b. Use the computer hardware in an efficient way
   c. Enhance the capability of computer hardware
   d. Execute user programs and make solving user problems easier

2. Advantages of multiprocessor OS:
   a. Increased throughput
   b. Increased memory space
   c. None of the above
   d. Both of the above

3. Which is not the scope of OS security:
   a. Access control
   b. Denial-of-Service (DoS) defense
   c. Worm detector
   d. None of the above

4. Which is the benefit of microkernel:
Part 3: A longer question (3 x 2 points each = 6 points)

The above figure shows a realistic cloud service scenario. A user, Alice, rents a virtual machine, VM1, in Amazon EC2 service. If Alice wants to access her application, App1, the request should go through the following “path”: Internet -> Firewall -> Machine Hardware -> VM Monitor -> VM1 -> OS1 -> App1. Please answer the following questions:

1. Why Amazon needs firewall?

Any reasonable answer is accepted. For example, Amazon needs to use firewall to filter some malicious network traffic, or they need to protect their inner-network.

2. Assume OS1 is a normal linux system (e.g., Ubuntu 12.04). What types of system calls it has?
Linux system calls should follow POSIX APIs, including 1) process control, 2) file manipulation, 3) device manipulation, 4) information maintenance, 5) communications and 6) protections.

0.5 for each type of system calls
0.5 for writing anything relevant

3. Suppose Bob rents another virtual machine, VM2, running on the same hardware machine with Alice. What problems may affect applications of Alice and Bob simultaneously?

Because the two VMs are running on the same physical machine and the same VM monitor, a software problem within VM monitor or hardware problem in that physical machine would make the both VMs failures, simultaneously.