# Homework 1 for CSC246

Homework 1 consists of six questions. Respond to each question and submit your work electronically using Moodle. Please submit your responses in pdf, doc, or plain old text. Put your name on your homework. Respond to each question in your own words.

If you need help, please contact the TA at once and arrange to get help. The TA's email address is on the syllabus.  
  
This homework is due on the date mentioned on the main website **by midnight.** This homework contains 100 points and is 10% of your total course grade.

You may use the web as a resource but you must list the URLs for those sites. Remember to answer each question in your own words.

*24 points*

## Question 1 Vocabulary

Define the following terms using the textbook as the primary reference and the internet as a secondary reference (*2 pts each*):

 operating system

* The operating system is the software system that manages all the computer hardware and other software to serve as an intermediary with the user.

 hard real-time

* A hard real-time means that the system must operate within the defined time constrain.

 interrupt driven

* The method the operating system uses to process. The method uses the occurrence of interrupt or trap to signal the event. The operating system will determine which action it should take based on the different type of interrupt.

 system call

* A system call is when the program makes a request to the operating system.

 embedded computing

* Embedded computing system is made up with both hardware and software. It is almost always real-time operating system.

 mainframe systems

* Mainframe systems are more powerful on processing than other type of computers. They are primarily design to optimize the hardware’s utilization.

 clustered systems

* Clustered systems are a set of connected individual systems. The systems shared storage and are linked through local-area network LAN or another interconnect.

 grid computing

* Grid computing combines computer resources from various system to form a computer network.

The Unix operating system was introduced to the world via the paper below. Read the paper and answer the questions following the citation.

|  |  |
| --- | --- |
|  | Dennis M. Ritchie and Ken Thompson.  **The UNIX time-sharing system**. *The Bell System Technical Journal*, 57(6):1905-1929, July/August 1978. Copyright 1978 AT&T. All rights reserved. (Available just below the main homework#1 doc on the main page.) |

Define the following terms as they are explained *in the paper* (*2 pts each*):

 C

* A language resembling BCPL with types and structures

 i-node

* i-node contain the descriptions of the file.

 **fork** system call

* the fork system call gives the existence of new process.

 Shell

* Shell is a command line interpreter which reads the line and interprets to what was requested from the user.

*12 points*

## Question 2: Cloud Computing

Explain what "cloud computing" is and how it works. (*6 pts*)

* Cloud computing is the to deliver the computing service such as servers, storage, etc, across the internet.

What companies or research institutions are interested in cloud computing, and why? (*6 pts*)

* The amazon elastic compute cloud are interested in cloud computing since they can use it to charge the users based on how much resource they use.

*20 points*

## Question 3: Operating System Threats

Computer *viruses* and *worms* exploit weaknesses in operating systems.

The textbook mentions *viruses* and *worms* in chapter 1 and provides definitions and examples in chapter 19 (*This may vary depending on your edition*). Read the sections on worms and viruses.   
  
Provide the authors' definition of *virus* and *worm*. (*10 pts*)

A virus is a fragment of code embedded in a legitimate program. Viruses are self-replicating and are designed to “infect” other programs.

A worm is a process that uses the spawn mechanism to duplicate itself. The worm spawns’ copies of itself, using up system resources and perhaps locking out all other processes.

Use the internet to find a description of the **BubbleBoy** virus and **explain what it was designed to do** (*5 pts*).

BubbleBoy is the first worm that spread with email and does not need the user to open the attachment. It executes immediately after the user open the email in outlook. It creates a

Read the textbook and explain what **Denial of Service** means (check the index for page/section) (*5pts*).

*15 points*

## Question 4: Hardware Protection

Explain how the following hardware protection mechanisms work and how they contribute to multiuser operating systems:

 base/limit registers (*5 pts*)

* Base and limit registers define the logical address space. The base registers hold physical memory address and the limit registers specifies the length of the process. The two registers work together to limit the access of the area of memory dedicated to the process. The operating system will then check each address accessed by the CPU.

 dual mode operation (*5 pts*)

* There are two separated modes of operation, user mode and kernel mode. The mode bit will help to indicate the current mode. There are some instructions that are designed as privileged instructions that are only executable in kernel mode. If a privileged instruction is attempted to execute under user mode, the hardware treats it as illegal and traps it to the operating system.

Windows operating systems sometimes *freeze*, a phenomenon commonly referred to as the *Blue Screen of Death*. Microsoft states that one condition that can cause the problem is **the privilege level of an operation is invalid**. Explain what this means in CSC244/246 terms. (*5 pts*)

* The program does not have a high enough permission level to complete an operation.

*15 points*

## Question 5: System Calls

Explain the basic difference between hardware interrupts and traps. (*5pts*)

* The basic difference between hardware interrupts and traps is that the interrupts are triggered by a hardware device whereas the traps are triggered by a software.

Explain how traps are used to implement system calls. (*5pts*)

* The traps allow the processor to enter the kernel mode for special privileges and execute the service.

What is a non-maskable interrupt, and how does a maskable interrupt differ from it? (*5pts*)

* A non-maskable interrupt is a type of interrupt that will always interrupt and can never be ignored. On the other side, a maskable interrupt can be ignored by masking it off.

*14 points*

## Question 6: System Boot

Explain what it means to **boot** a system. (*7pts*)

* To boot a system is the procedure to start a computer by loading the kernel. The bootstrap program in the kernel load it into the main memory and start the execution.

Investigate and explain what BIOS is and why it is important from an operating system point of view. (*7pts*)

* BIOS stands for Basic Input/Output System. It is stored in the motherboard and initializes the hardware before the booting process of operating system. The BIOS is important because it includes the instructions to load the operating system into memory.

<https://en.wikipedia.org/wiki/Grid_computing>

<http://openbookproject.net/courses/intro2ict/hardware/booting.html>

<https://www.geeksforgeeks.org/dual-mode-operations-os/>

<https://www.f-secure.com/v-descs/bubb-boy.shtml>

<http://virus.wikidot.com/bubbleboy>

<https://en.wikipedia.org/wiki/Mainframe_computer>

<https://www.quora.com/Why-are-System-calls-also-called-traps>