**CS 3343 Operating Systems Assignment 1 12 points**

**Due January 29 at 5pm**

**One homework assignment submission per student. Microsoft Word format only. No AI or GPT use. Cite all references.**

**Email your answers to me at** [**harringp@nsuok.edu**](mailto:harringp@nsuok.edu)

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**Chapter 1**

**Use the slides or textbook definitions to answer the following:**

1. Define the following:
   1. Kernel **(Pg 6)**
      1. The one program running at all times on the computer.
   2. Bootstrap program **(Pg 7)**
      1. That initial program that runs to start the computer. Typically held on ROM or EEPROM
   3. Parallel system **(Pg 14)**
      1. Multiprocessor systems. Such systems have two or more processors in close communication, sharing the computer bus and sometimes the clock, memory, and peripheral devices.
   4. Graceful degradation **(Pg 14)**
      1. The ability to continue providing service proportional to the level of surviving hardware.
   5. Blade server **(Pg 16)**
      1. Relatively recent development in which multiple processor boards, I/O boards, and networking boards are placed in the same chassis. The difference is that each blade-processor board boots independently and runs its own operating system.
   6. Beowulf Cluster **(Pg 18)**
      1. Designed to solve high-performance computing tasks. Consists of commodity hardware, connected via a simple local-area network. No single specific software package is required to construct a cluster. Rather, the nodes use a set of open-source software libraries to communicate.
   7. Multiprogramming **(Pg 19)**
      1. Increases CPU utilization by organizing jobs so that the CPU always has one to execute.
   8. Multiprocessing **(Pg 15)**
      1. Symmetric and Asymmetric.
      2. Symmetric = each processor performs all basic tasks within the operating system. No boss-worker relationship exists between processors.
      3. Asymmetric = each processor is assigned a specific task. A boss processor controls the system.
   9. Dual-mode operation **(Slides)**
      1. Allows OS to protect itself and other system components.
      2. User Mode and Kernel Mode.
      3. Mode Bit provided by hardware.
   10. Program Counter **(Slides)**
       1. Specifies location of next instruction to execute.
       2. Single-threaded processes have one counter.
       3. Multi-threaded have one counter per thread.
   11. Caching **(Pg 27-28)**
       1. An important principle of computer systems. Information is normally kept in some storage system. As it is used, it is copied into a faster storage system, which is known as the cache, on a temporary basis.
   12. Protection **(Pg 30)**
       1. Any mechanism for controlling the access of processes or users to the resources defined by a computer system.
   13. Security **(Pg 30)**
       1. To defend a system from external and internal attacks
   14. Distributed system **(Pg 37)**
       1. A collection of physically separate computer systems that are networked to provide users with access to various resources that the system maintains.
   15. Process **(Pg 20)**
       1. A program loaded into memory and executed. When it executes, it typically executes for only a short time before it either finishes or needs to perform I/O
   16. Network operating system **(Pg 38)**
       1. Operating system that provides features such as file sharing across the network, along with a communication scheme that allows different processes on different computers to exchange messages.
   17. Firewall **(Pg 35)**
       1. A security system to protect networks from security breaches.
   18. Time sharing system **(Pg 20)**
       1. Logical extension of multiprogramming. CPU executes multiple jobs by switching among them. Requires an interactive computer system.
   19. Symmetric multiprocessing **(Pg 15)**
       1. Each processor performs all tasks within the operating system.
   20. Asymmetric multiprocessing **(Pg 15)**
       1. Each processor is assigned a specific task
   21. NUMA **(Pg 16)**
       1. Non-uniform memory access. Some parts of memory may take longer to access than other parts, creating a performance penalty.
2. What are the goals of a Computer Operating System from the users view versus the system view? **(Pg 4-5)**
   1. The user’s view is to maximize the work (or play) that the user is performing. OS is designed for ease of use.
   2. The system view says that the OS is the program most intimately involved with the hardware. In this view the OS is a resource allocator.
3. List two reasons why secondary storage is needed in a computer system. **(Pg 10)**
   1. Main memory is a volatile storage device that is built for short term storage of small quantities. This is why secondary storage is required. Secondary storage is used for larger files that need to be saved long term.
4. What is the main purpose of direct memory access relative to CPU utilization? **(Pg 12)**
   1. It helps to allow the CPU to do other work. Direct Memory Access allows for device controller to transfer an entire block of data directly to or form its own buffer storage to memory. This is with no intervention from the CPU. This also allows for only one interrupt to be generated per block rather than one interrupt per byte.
5. List the three main advantages of a multiprocessor system. **(Pg 14)**
   1. Increased throughput, economy of scale, and increased reliability.
6. What is the difference between asymmetric and symmetric clustering? **(Slides)**
   1. Asymmetric has one machine in hot-standby mode.
   2. Symmetric has multiple nodes running applications, monitoring each other.
7. What causes cache coherency problems? **(Pg 29)**
   1. In a multiprocessor system, there may be a copy of “A” for example may exist simultaneously in several caches. Since the CPU’s can all execute in parallel, there must be an update to the value of “A” in one cache is immediately reflected in the other caches. Issues that cause cache coherency problems are usually at the hardware level.