**Lecture 1**

**Worksheet 1**

1. What are the three main purposes of an Operating System?
   1. It is to provide an environment for a user to execute programs conveniently and efficiently
   2. To simulate features not available on hardware (Virtualization/ Virtual Machines)
   3. To control all the computer’s resources and to provide base upon which the application can be written.
2. What is multiprogramming? What is the main advantage of multiprogramming?
   1. Multiprogramming is when you keep more programs in the memory to increase CPU utilization. Several jobs are kept in the main memory at the same time and the CPU is multiplexed among them to prevent the CPU from idling too much.
3. What is time sharing? What is the main advantage of a time-shared system?
   1. Time sharing is a variant of multiprogramming where the processor time is shared across multiple tasks. The main advantage of the time-shared system is to provide an interactive use of a computer system at a reasonable cost.
4. In a multiprogramming and time-sharing environment, several users share the system simultaneously. This situation can result in various security problems.
   1. What are the problems?
      1. One user can read the private data of another user (Privacy is violated)
      2. One user can corrupt the private date of another user (Integrity is violated)
      3. One user can prevent another user from getting anything done (Availability is violated)
   2. Can we ensure the same degree of security in time-shared machine as we have in a dedicated machine? Explain your answer.
      1. Yes, we can ensure the operating system prevents any sharing of the data between the users, whether it be read/write. And ensure that resources are shared fairly in which we can have the same level of security.
      2. No, we can never be sure that our software doesn’t have bugs so we can’t prevent the data being shared fairly or even allocate resources appropriately.
5. What is the main difference between operating systems for mainframe computers and personal computers?
   1. Operating Systems for Personal Computers are focused more on a single user multitasking system whereas for mainframe computers it is focused more on multiuser multitasking system. This means there is extensive scheduling of resources by the Operating System in a Mainframe in comparison to personal computers as many users may access the mainframe simultaneously.
6. We have stressed the need for an OS to make efficient use of the computing hardware. What is it appropriate for the OS to forsake this principle and to ‘waste’ resources?
   1. A single-user systems should maximize use of the system for the user. A GUI might “waste” CPU cycles, but it optimizes the user’s interaction with the system.
7. What is the purpose of interrupts? What are the differences between a trap and an interrupt?
   1. An interrupt is a signal sent to the CPU to notify the CPU that it requires its attention away from whatever set of instructions the CPU is handling now. Interrupts are generated by Hardware Devices and once an interrupt is raised the CPU will suspend its current activity, store it, call the relevant Interrupt Service Routine and then upon completion go back to executing the commands that were suspended. The difference between a trap and an interrupt is that a trap is a signal raised from a user program that indicates the need for the operating system to perform some functionality.
8. What is a privileged instruction? Which of the following instructions should be privileged?
   1. Privileged instructions are instructions that can damage the computer’s physical hardware.

|  |  |
| --- | --- |
| * + 1. Set value of timer | * + 1. Not Privileged |
| * + 1. Read the clock | * + 1. Not Privileged |
| * + 1. Clear memory | * + 1. Privileged |
| * + 1. Turn-off interrupts | * + 1. Privileged |
| * + 1. Switch from user mode to monitor mode | * + 1. Privileged |
| * + 1. Modifying base and limit registers | * + 1. Privileged |
| * + 1. Issue a trap instruction | * + 1. Not Privileged |
| * + 1. Access I/O Device | * + 1. Not Privileged |
| * + 1. Modify entries in device status table | * + 1. Privileged |

1. What is the purpose of the command interpreter? Why is it usually separate from the kernel? By what other names is it know?
   1. It reads commands from the user or from a file of commands and executes them, usually by turning them intone or more system calls. It is usually not part of the kernel since the command interpreter is subject to changes.
2. What is the purpose of system calls? Describe three methods to pass parameters to the OS?
   1. The system call provides an interface to the operating to the operating system services. Application developers often do not have direct access to the system calls, but can access them through a application programming interface.
      1. Parameters can be passed in registers
      2. When there are more parameters than registers, parameters can be stored in a block and the block address can be passed as a parameter to a register.
      3. Parameters can also be pushed on or popped off the stack by the operating system.
3. Give examples of Unix System Calls for each of the following system calls major categories:

|  |  |
| --- | --- |
| * 1. Process Control | * 1. exec() |
| * 1. File Manipulation | * 1. chmod() |
| * 1. Device Manipulation | * 1. ioctl() |
| * 1. Information Maintenance | * 1. ??? |
| * 1. Communications | * 1. msgget() |