

**Objectives:**

The objective of this assignment is to introduce the student to some concepts of Operating Systems that are of great importance to this course.

**What to Do:**

1) **Read** Chapters 1 and 2 of the textbook *Operating System Concepts*, 10<sup>th</sup> edition. These two chapters introduce many concepts regarding how operating systems work. Read over this, but don't try to memorize it! The following assignment questions draw your attention to some of the most important topics.

2) **Answer the following questions:**

Q<sub>1</sub>. In a multiprogramming and time-sharing environment, several users share the same system simultaneously. This situation can result in various security problems.

- What are two such problems?
- Can we ensure the same degree of security in a time-shared machine as in a dedicated machine? Explain your answer.

Q<sub>2</sub>. The issue of resource *utilization* shows up in different forms in different types of operating systems. List what *resources* must be managed carefully in the following settings:

- Mainframe* or *minicomputer* systems
- Workstations* connected to *servers*
- Mobile* computers.

Q<sub>3</sub> What is the purpose of *interrupts*? How does an interrupt differ from a *trap*? Can *traps* be generated intentionally by a user program? If so, for what purpose?

Q<sub>4</sub> Direct memory access (*DMA*) is used for high-speed I/O devices in order to avoid increasing the CPU's execution load.

- How does the CPU interface with the device to coordinate the transfer?
- How does the CPU know when the memory operations are complete?
- The CPU is allowed to execute other programs while the DMA controller is transferring data. Does this process interfere with the execution of the user programs? If so, describe what forms of interference are caused.

Q<sub>5</sub>. A running program produces data at a rate (in Kbytes/second) determined by the function:

$$P(t) = \begin{cases} 10t & \text{when } 0.0 \leq t \leq 0.5 \\ 5 & \text{when } 0.5 < t \leq 3.5 \\ 10(4-t) & \text{when } 3.5 < t \leq 4.0 \\ 0 & \text{elsewhere.} \end{cases}$$

Where,  $t$  is the burst period. The data is consumed by another running program at a rate determined by the function:

$$C(t) = \begin{cases} 2.5t & \text{when } 0.0 \leq t \leq 0.8 \\ 2 & \text{when } 0.8 < t \leq 3.2 \\ 10 - 2.5t & \text{when } 3.2 < t \leq 4.0 \\ 0 & \text{elsewhere.} \end{cases}$$

If the burst period,  $T$ , is known to be 5.0 seconds, what is the minimum necessary buffer size?

Q<sub>6</sub> Describe a mechanism for enforcing memory protection in order to prevent a program from modifying the memory associated with other programs.

Q<sub>7</sub> What are the five major activities of an operating system in regard to file management?

Q<sub>8</sub> What are the advantages and disadvantages of using the same system-call interface for manipulating both files and devices?

Q<sub>9</sub> What are the two models of inter-process communication? What are the strengths and weaknesses of the two approaches?

Q<sub>10</sub> How are *iOS* and *Android* similar? How are they different?