**Chapter 8 - Exercises**

8.1 What is an operating system?

8.2 List and briefly define the key services provided by an OS.

8.3 List and briefly define the major types of OS scheduling.

8.4 What is the difference between a process and a program?

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8.8 Must the pages of a process in main memory be contiguous?

8.9 Is it necessary for the pages of a process in main memory to be in sequential order?

8.10 What is the purpose of a translation lookaside buffer?

**Answers to Questions**

**8.1. What is an operating system?**

**- The OS is a program** that **manages the computer’s resources**, **provides services** for programmers, and **schedules the execution** of other programs **on a processor**.

**8.2. List and briefly define the key services provided by an OS.**

**- Program creation:** The OS provides a variety of **facilities and services**, such as **editors** and **debuggers**, to assist the programmer in creating programs.

**- Program execution:** A number of **steps need to be performed** to execute a program. Instructions and data must **be loaded** into main memory, I/O devices and files must **be initialized**, and other resources must **be prepared**. **The OS handles all of this** for the user.

**- Access to I/O devices:** Each I/O device requires its own specific set of instructions or control signals for operation. The OS takes care of these details.

- **Controlled access to files:** OS worries about the **details involved** such as understanding the **nature of the I/O device** and also the **file format** on the storage medium. Further, in the case of a system with **multiple simultaneous users**, the OS can provide **protection mechanisms** to control access to the files.

- **System access:** It provides protections of resources and data from unauthorized users and also resolves conflicts for resource contention.

- **Error detection and response:** The OS must make the response that clears error conditions with the least impact on running applications.

- **Accounting:** A good OS collects usage statistics for various resources and monitor performance parameters such as response time. On any system, this information is useful in anticipating the need for future enhancements and in tuning the system to improve performance.

**8.3. List and briefly define the major types of OS scheduling.**

**- Long-term scheduling:** Determines which programs are admitted to the system for processes. It controls the **degree of multiprogramming** (number of processes in memory).

**- Medium-term scheduling:** This is **part of the swapping section**. Typically, the **swapping decision** is based on the need to **manage the degree of multiprogramming**. Determines whether to add to the number of processes that are partially or fully in main memory.

**- Short-term scheduling:** Also known as the **dispatcher**. Executes frequently and makes the fine-grained decision of which job to execute next.

**- I/O scheduling:** The decision as to which process's pending I/O request shall be handled by an available I/O device.

**8.4. What is the difference between a process and a program?**

- **Program:** executable file stored in external memory.

- **Process:** program in execution.

**8.5. What is the purpose of swapping?**

- The **purpose of swapping** is to provide for **efficient use of main memory** for **processes execution**. It allows **temporarily removing** processes not in a ready state to **replace with** processes in a ready state.

**8.6. If a process may be dynamically assigned to different locations in main memory, what is implication for the addressing mechanism?**

- The **addressing mechanism** must **keep track** of the **physical addresses** of the process, as well as the **logical addresses** used for **swapping out** the process.

**8.7. Is it necessary for all of the pages of a process to be in main memory while the process is executing?**

- No, only **necessary part** of each process is loaded.

**8.8. Must the pages of a process in main memory be contiguous?**

- No.

**8.9. Is it necessary for the pages of a process in main memory to be in sequential order?**

- No.

**8.10. What is the purpose of a translation lookaside buffer?**

- The TLB **is a cache** that contains those page table **entries** that have been most recently used. Its purpose is **to avoid**, most of the time, **having to go to disk** to retrieve a page table entry.