Operating System Course Report - First Half of the Semester

A class

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Contents

1 Introduction

This report summarizes the topics covered during the first half of the Operating System course. It includes theoretical concepts, practical implementations, and assignments. The course focuses on the fundamentals of operating systems, including system architecture, process management, CPU scheduling, and deadlock handling.

2 Course Overview

2.1 Objectives

The main objectives of this course are:

- To understand the basic components and architecture of a computer system.
- To learn process management, scheduling, and inter-process communication.
- To explore file systems, input/output management, and virtualization.
- To study the prevention and handling of deadlocks in operating systems.

2.2 Course Structure

The course is divided into two halves. This report focuses on the first half, which covers:

- Basic Concepts and Components of Computer Systems
- System Performance and Metrics
- System Architecture of Computer Systems
- Process Description and Control
- Scheduling Algorithms
- Process Creation and Termination

- Introduction to Threads
- File Systems
- Input and Output Management
- Deadlock Introduction and Prevention
- User Interface Management
- Virtualization in Operating Systems

3 Topics Covered

3.1 Basic Concepts and Components of Computer Systems

3.1.1 Sistem Komputer

3.1.2 *Hardware*

Hardware adalah komponen fisik yang membentuk komputer dan memungkinkan komputer untuk menjalankan berbagai tugas. Tanpa *hardware*, perangkat lunak (*software)* tidak akan dapat berfungsi, karena perangkat lunak membutuhkan medium fisik untuk dijalankan dan berinteraksi dengan pengguna.

Hardware merujuk pada semua komponen fisik yang terdapat dalam sebuah sistem komputer. Ini adalah bagian dari komputer yang dapat kita sentuh, lihat, dan rasakan, seperti layar *monitor*, *keyboard*, *mouse*, dan *prosesor* (CPU) . Berikut adalah beberapa komponen utama *hardware* yang terdapat dalam sebuah komputer.

1. ***Prosesor* (CPU - *Central Processing Unit*)**

   CPU adalah otak dari komputer yang menjalankan instruksi dan memproses data. Semua perhitungan dan operasi yang dilakukan oleh komputer bergantung pada CPU.

2. **Memori (RAM - *Random Access Memory*)**

   Ini adalah tempat penyimpanan sementara yang digunakan komputer untuk menyimpan data dan instruksi yang sedang diproses oleh

CPU. Semakin besar kapasitas RAM, semakin banyak data yang bisa diproses secara bersamaan, yang berarti komputer akan bekerja lebih cepat.

3. **Penyimpanan (*Hard Disk*, SSD)**

   Ini adalah tempat di mana semua data dan program disimpan secara permanen. *Hard disk* adalah perangkat penyimpanan tradisional dengan kapasitas besar, sedangkan SSD (*Solid State Drive*) adalah perangkat penyimpanan yang lebih cepat dan lebih andal, meskipun biasanya lebih mahal.

4. ***Motherboard***

   Ini adalah papan *sirkuit* utama yang menghubungkan semua komponen komputer, termasuk CPU, RAM, penyimpanan, dan komponen lainnya. *Motherboard* juga menyediakan koneksi untuk perangkat eksternal seperti *mouse* dan *keyboard*.

5. **Kartu Grafis (GPU - *Graphics Processing Unit*)**

   Ini adalah komponen yang bertanggung jawab untuk memproses grafis, khususnya dalam aplikasi yang membutuhkan *rendering* visual tinggi seperti *game* dan desain grafis.

6. **Perangkat *Input* dan *Output***

   Perangkat input seperti *keyboard*, *mouse*, dan *scanner* digunakan untuk memasukkan data ke dalam komputer. Perangkat *output* seperti *monitor* dan *printer* digunakan untuk menampilkan hasil dari pemrosesan data.

Hardware merupakan komponen *esensial* dalam sistem komputer. Tanpa *hardware*, perangkat lunak tidak dapat berjalan. Komponen-komponen seperti CPU, RAM, penyimpanan, *motherboard*, kartu grafis, dan perangkat *input/output* bekerja sama untuk memungkinkan komputer menjalankan berbagai tugas dan memenuhi kebutuhan pengguna. Pemahaman mendalam tentang fungsi *hardware* membantu pengguna dalam memaksimalkan penggunaan komputer dan memastikan kinerja yang optimal.

3.2 System Performance and Metrics

This section introduces various system performance metrics used to measure the efficiency of a computer system, including throughput, response time, and utilization.

3.3 System Architecture of Computer Systems

Describes the architecture of modern computer systems, focusing on the interaction between hardware and the operating system.

3.4 Process Description and Control

Processes are a central concept in operating systems. This section covers:

- Process states and state transitions
- Process control block (PCB)
- Context switching

3.5 Scheduling Algorithms

This section covers:

- First-Come, First-Served (FCFS)
- Shortest Job Next (SJN)
- Round Robin (RR)

It explains how these algorithms are used to allocate CPU time to processes.

3.6 Process Creation and Termination

Details how processes are created and terminated by the operating system, including:

- Process spawning
- Process termination conditions

3.7 Introduction to Threads

This section introduces the concept of threads and their relation to processes, covering:

- Single-threaded vs. multi-threaded processes
- Benefits of multithreading

Figure 1: Ini adalah gambar contoh dari multithreading.

Seperti yang terlihat pada Gambar 1, inilah cara menambahkan gambar dengan keterangan.

3.8 File Systems

File systems provide a way for the operating system to store, retrieve, and manage data. This section explains:

- File system structure
- File access methods
- Directory management

3.9 Input and Output Management

Input and output management is key for handling the interaction between the system and external devices. This section includes:

- Device drivers
- I/O scheduling

3.10 Deadlock Introduction and Prevention

Explores the concept of deadlocks and methods for preventing them:

- Deadlock conditions
- Deadlock prevention techniques

3.11 User Interface Management

This section discusses the role of the operating system in managing the user interface. Topics covered include:

- Graphical User Interface (GUI)
- Command-Line Interface (CLI)
- Interaction between the user and the operating system

3.12 Virtualization in Operating Systems

Virtualization allows multiple operating systems to run concurrently on a single physical machine. This section explores:

- Concept of virtualization
- Hypervisors and their types
- Benefits of virtualization in modern computing

4 Assignments and Practical Work

4.1 Assignment 1: Process Scheduling

Students were tasked with implementing various process scheduling algorithms (e.g., FCFS, SJN, and RR) and comparing their performance under different conditions.

4.1.1 Group 1

```
    class Process:
    def __init__(self, pid, arrival_time, burst_time):
        self.pid = pid
        self.arrival_time = arrival_time
        self.burst_time = burst_time
        self.completion_time = 0
        self.turnaround_time = 0
        self.waiting_time = 0
```

Header 1	Header 2	Header 3
Row 1, Column 1	Row 1, Column 2	Row 1, Column 3
Row 2, Column 1	Row 2, Column 2	Row 2, Column 3

Table 1: Your table caption

4.2 Assignment 2: Deadlock Handling

In this assignment, students were asked to simulate different deadlock scenarios and explore various prevention methods.

4.3 Assignment 3: Multithreading and Amdahl's Law

This assignment involved designing a multithreading scenario to solve a computationally intensive problem. Students then applied **Amdahl's Law** to calculate the theoretical speedup of the program as the number of threads increased.

4.4 Assignment 4: Simple Command-Line Interface (CLI) for User Interface Management

Students were tasked with creating a simple **CLI** for user interface management. The CLI should support basic commands such as file manipulation (creating, listing, and deleting files), process management, and system status reporting.

4.5 Assignment 5: File System Access

In this assignment, students implemented file system access routines, including:

- File creation and deletion
- Reading from and writing to files
- Navigating directories and managing file permissions

5 Conclusion

The first half of the course introduced core operating system concepts, including process management, scheduling, multithreading, and file system access. These topics provided a foundation for more advanced topics to be covered in the second half of the course.