

Study Experiment Details:

## **Experiment: Analysis of Recent Trends and Issues in Memory Management**

**Objective:** To study and analyze recent trends, issues, and solutions in memory management techniques used in modern operating systems.

### **Tasks:**

#### **1. Literature Review:**

- Conduct a comprehensive literature review on recent research papers, articles, and journals related to memory management in operating systems.
- Identify and summarize recent trends, challenges, and advancements in memory management techniques such as:
  - **Dynamic Memory Allocation:** Techniques like buddy systems, slab allocation, and advanced data structures.
  - **Virtual Memory Management:** Paging, segmentation, TLB optimizations.
  - **Memory Protection:** Security enhancements and hardware support.
  - **Memory Compression and Deduplication:** Techniques to reduce memory footprint.
  - **Garbage Collection:** Strategies in managed languages and real-time systems.

#### **2. Case Study:**

- Select a recent operating system or a research project that focuses on innovative memory management techniques (e.g., Linux kernel updates, research projects like zswap, zsmalloc, etc.).
- Analyze the design principles, implementation details, and performance evaluations of the chosen system or project.
- Compare it with traditional approaches and highlight the improvements and challenges addressed.

#### **3. Discussion and Conclusion:**

- Discuss the implications of the findings in terms of real-world applications and emerging trends in memory management.
- Evaluate the effectiveness of recent solutions in addressing existing challenges (e.g., scalability, security, efficiency).
- Propose potential future research directions or improvements based on the analysis and identified limitations.

### **Extra credits for:**

#### **1. Experimental Setup:**

- Set up a practical experiment to simulate and measure memory management techniques.
- Use tools like **perf**, **valgrind**, or custom-built programs to profile memory usage, performance metrics (e.g., throughput, latency), and efficiency (e.g., fragmentation).

## 2. **Performance Evaluation:**

- Perform quantitative analysis and benchmarking of memory management techniques.
- Measure impact on overall system performance.
- Present findings. (Use graphs, charts, and comparative analysis to visualize the performance benefits and trade-offs.)

### **Deliverables:**

- **Report:** Summarizing the literature review, case study analysis, experimental setup, results, and conclusions. **Check report plagiarism on Turnitin.**
- **Presentation:** Slides summarizing key findings, methodology, and implications for memory management in modern operating systems.
- **Demo or Simulation:** Optionally, demonstrate practical implementations or simulations of memory management techniques during the presentation.