Premier University, Department of CSE
Fall 2024, 6th Semester, Assignment, February 2025
Course Title: Operating Systems, Course Code: CSE 333
Course Outcome: CO3, Total Marks: 10

Description: Suppose your company is developing a high-performance computing system that requires efficient main memory management to handle multiple concurrent processes. The system must ensure optimal memory allocation, minimize fragmentation, and provide fast memory access to processes. However, the system is facing challenges related to memory allocation, fragmentation, and access latency, which are affecting overall performance. Your task is to design a memory management system that addresses these issues.

Objectives:

1. **Memory Allocation:** Design a memory allocation system that efficiently allocates memory to processes while minimizing internal and external fragmentation. The system should support dynamic memory allocation and deallocation.
2. **Fragmentation Management:** Implement strategies to handle both internal and external fragmentation. Your system should include mechanisms such as compaction, paging, or segmentation to reduce fragmentation and improve memory utilization.
3. **Memory Access Optimization:** Develop techniques to optimize memory access times for processes. This includes implementing caching strategies, memory hierarchy management, and ensuring locality of reference to reduce access latency.
4. **Scalability and Performance:** Ensure that your memory management system is scalable and can handle many processes efficiently. The system should maintain high performance even under heavy load and support concurrent memory access by multiple processes.

Investigation:

You should identify the specific scenarios or conditions in which memory fragmentation and access latency are occurring. Moreover, analyzing memory usage patterns and reviewing system architecture is required.

Evaluation:

Students need to justify their memory management design, fragmentation handling, access optimization, scalability, and performance optimization.

Design:

Students' solution design must achieve the given objectives.

Deliverables:

A printed assignment reporting the following tasks:
(i) A properly reasoned memory management system.
(ii) Briefly address the complex problem-solving questions:

a. Does the solution need in-depth engineering knowledge?
b. Does the solution involve wide-ranging or conflicting technical, engineering, and other issues?
c. Is the solution well-known, or does it require abstract thinking and analysis to formulate?
d. Does the solution involve infrequently encountered issues?
e. Does the solution need adherence to standards and codes of practice?
f. Does the solution involve stakeholders with conflicting technical requirements?
g. Does the solution involve interdependence between sub-problems or parts?

Rubrics for Assignment marking:

Task	**Criteria**	**Good (4-5)**	**Moderate (2-3)**	**Poor (1)**
i.	Problem solution	Properly or near appropriately reasoned solution	Appropriate solution for some cases	Inappropriate or no solution
ii.	Problem analysis	In-depth analysis	Shallow analysis	Incomplete analysis