**Operating Systems: CSE316**

**CA3 Topics**

As part of the CA3- term paper on operating systems concepts, you are encouraged to explore various broad and encompassing topics that reach into the fundamental concepts and advancements within this crucial field. The term papers should aim to investigate, analyze, and present insights into the intricacies (a quality of being complex) of operating systems. Sharing a list of broad topics of operating systems. Term papers may belong to any of these fields. **The topics are not limited to the shared and can be extended but must be confined to concepts of operating systems. Before selecting topics other than those mentioned, discuss them with your subject teacher.**

OS Concepts related to:

I. Kernel:

1. Scheduling algorithms for real-time and embedded systems

2. Security vulnerabilities and mitigation strategies in kernel code

3. Hardware resource management (CPU, memory, I/O) optimization

4. Microkernel versus monolithic kernel design trade-offs

5. Kernel virtualization and containerization (e.g., Docker, Kubernetes)

II. Memory Management:

1. Efficient paging and segmentation techniques for virtual memory

2. Garbage collection algorithms for dynamic memory allocation

3. Memory leak detection and prevention mechanisms

4. Page migration and swapping for optimal memory utilization

III. Process Management:

1. Thread scheduling and synchronization for multi-threaded applications

2. Inter-process communication (IPC) methods and performance optimization

3. Deadlock detection and avoidance algorithms

4. Resource allocation and priority scheduling for fairness and efficiency

IV. File Systems:

1. Design and implementation of journaling file systems for data integrity

2. Distributed file systems for collaborative data access and scalability

3. Efficient data structures and algorithms for file indexing and searching

4. File system resilience against crashes and data corruption

V. Security:

1. Access control mechanisms and user authentication protocols

2. Intrusion detection and prevention systems (IDS/IPS) for OS protection

3. Secure kernel design and sandboxing techniques

4. Cryptography integration for data encryption and secure communication

VI. Operating Systems for Emerging Technologies:

1. Quantum computing and its impact on OS design

2. Operating systems for the Internet of Things (IoT) and edge computing

3. Wearable device operating systems and resource management challenges

4. Operating systems for autonomous vehicles and real-time systems

VII. Performance and Optimization:

1. System call optimization and kernel-user space communication overhead

2. Power management and energy efficiency techniques in operating systems

3. OS Benchmarking methodologies and performance analysis tools

4. Resource utilization analysis and optimization for specific workloads

VIII. User Interface and System Design:

1. Human-computer interaction (HCI) principles in OS design

2. Accessibility features and inclusive design for diverse users

3. Novel user interfaces for specific domains (e.g., virtual reality)

4. System administration tools and automation mechanisms