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Subject Name	Operating system 2	

Name of the Assessment	Assignment 1
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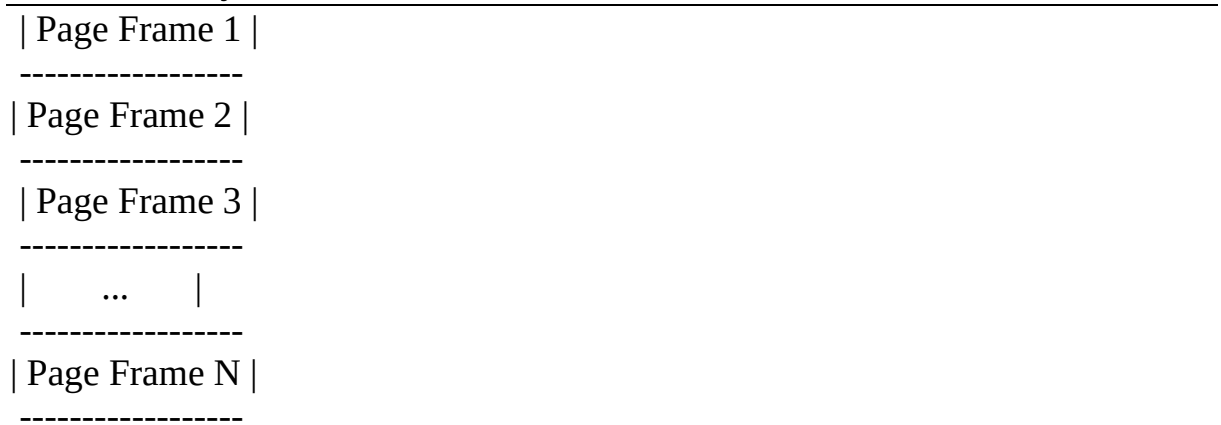
1.Explain page replacement policies explain with block diagram?

Answers:

Page replacement policies are used in demand-paged memory management systems to decide which pages should be evicted from the main memory (M.M) when a page fault occurs and there are no free page frames available.

Here's a simplified block diagram to help visualize the process:



In the main memory, there are multiple page frames that can hold pages. When a page fault occurs, the operating system needs to determine which page should be replaced with the incoming page from the disk.

There are various page replacement policies, each with its own algorithm to make this decision. Some commonly used page replacement policies include:

1. FIFO (First-In-First-Out): This policy replaces the page that has been in the main memory the longest. It follows a queue-like structure, where the page that entered first is the first to be replaced.

2. LRU (Least Recently Used): This policy replaces the page that has not been accessed for the longest time. It keeps track of the access history of each page and selects the one that was least recently used.

3. LFU (Least Frequently Used): This policy replaces the page that has been accessed the least number of times. It maintains a count of each page's access frequency and selects the one with the lowest count.

4. Optimal: This is an idealized page replacement policy that selects the page that will not be used for the longest time in the future. It requires knowledge of the future page accesses, which is not practical in real-time systems but serves as a benchmark for other policies.

The chosen page replacement policy determines the algorithm used to select the page to be replaced. Each policy has its own advantages and trade-offs in terms of efficiency and fairness.

2. Explain Thrashing?

Answers:

Thrashing occurs when a computer's virtual memory resources are overused, leading to a constant state of paging and page faults.It inhibits most application level processing and causes the overall performance of the computer to degrade or collapse.

The situation can persist indefinitely until the user closes some running applications or active processes free up additional virtual memory resources.

When a system is thrashing, it is overwhelmed by the demand for memory and is unable to effectively allocate resources. This can happen when there are too many programs running simultaneously or when the programs are requesting more memory than is available. As a result, the system spends more time swapping data in and out of memory than actually executing the tasks at hand.

Thrashing can significantly slow down the performance of a system, causing delays and unresponsiveness. It can also lead to excessive disk activity and increased wear on the storage device.

To mitigate thrashing, it is important to ensure that the system has enough physical memory to handle the demands of the running programs. Additionally, optimizing the memory management algorithms and prioritizing tasks can help prevent or reduce thrashing.

3. Explain kernal memory allocation?

Answers:

Kernel memory allocation is a crucial aspect in operating system design. It involves allocating memory specifically for kernel-level operations and data structures. Let's explore the methods used for kernel memory allocation:

Buddy System:

- The **buddy system** is an efficient memory allocation algorithm commonly used for kernel memory management.
- Here's how it works:
    1. Divide memory into blocks of a fixed size (usually powers of two).
    2. When a request for memory is made, find the smallest available block that can satisfy the request.
    3. If the block is larger than needed, split it into two equal-sized "buddies."
    4. Continue recursively until the exact requested size or the smallest possible block is found.

Types of Buddy Systems:

- Binary buddy system
- Fibonacci buddy system
- Weighted buddy system
- Tertiary buddy system

Slab System:

The slab system is specifically designed for kernel memory allocation.

Key features:

1. Divides memory into fixed-size caches or "slabs."
2. Each slab contains a set of objects of the same type (e.g., file descriptors, inodes).
3. When a memory request is made, check if an available object exists in the appropriate slab cache.
4. If not, allocate a new slab and add it to the cache.

4.Explain the complete lifecycle of memory allocation to process?

Answers:

When a process is created, it needs memory to store its instructions, data, and variables. The process goes through several stages during its lifecycle in terms of memory allocation.

1. Requesting Memory: The process requests memory from the operating system. This can be done through system calls or memory allocation functions provided by the programming language.
2. Memory Allocation: The operating system allocates memory to the process. This is typically done in two main areas: the stack and the heap.

- Stack: The stack is used for storing local variables, function calls, and other temporary data. Memory allocation in the stack is automatic and follows a Last-In-First-Out (LIFO) approach. Each time a function is called, a new stack frame is created, and when the function returns, the stack frame is deallocated.
- Heap: The heap is used for dynamic memory allocation, such as when the process needs to allocate memory at runtime. The process explicitly requests memory from the heap and is responsible for managing it, including allocating and freeing the memory when it's no longer needed.

3. Accessing Memory: Once memory is allocated, the process can access and manipulate the data stored in it. This includes reading from and writing to memory locations, performing calculations, and executing instructions.

4. Releasing Memory: When the process no longer needs certain memory, it should release it to avoid memory leaks and improve resource utilization. This is done by explicitly deallocating memory from the heap or allowing the stack frames to be automatically deallocated as functions return.

5. Terminating the Process: When a process terminates, either by completing its execution or being explicitly terminated, the operating system frees all the memory allocated to that process. This ensures that the memory is available for other processes to use.

It's important for a process to manage memory effectively to avoid issues like memory leaks, excessive memory usage, and crashes. Programming languages often provide memory management features, such as garbage collection, to automate memory deallocation and improve memory efficiency**.**

5.Explain the process of demand paging?

Demand paging is a memory management technique used by operating systems to optimize memory usage. In demand paging, not all pages of a process are loaded into memory at once. Instead, pages are loaded into memory only when they are needed, or "demanded," by the process. Here's how the process of demand paging works:

1. Initial Page Loading: When a process is first loaded into memory, only a few pages, known as the initial pages, are loaded. These initial pages typically include the starting point of the program and any necessary system libraries.

2. Page Fault Handling: When the process tries to access a page that is not currently in memory, a page fault occurs. The operating system then handles this page fault by bringing the required page into memory from secondary storage, such as the hard disk.

3. Swapping Pages: To make room for the demanded page, the operating system may need to swap out a page from memory. This is done by selecting a victim page, which is a page that is currently in memory but not actively used, and swapping it out to secondary storage.

4. Updating Page Tables: The page table, which keeps track of the mapping between virtual and physical memory addresses, is updated to reflect the new location of the demanded page in memory.

5. Resuming Execution: Once the demanded page is loaded into memory and the page table is updated, the process can resume its execution from where it was interrupted. The process continues to demand pages as needed, and the operating system handles any subsequent page faults.

Demand paging helps optimize memory usage by loading only the necessary pages into memory, which reduces the overall memory footprint of a process. It allows for efficient utilization of physical memory resources and enables the execution of larger programs that may not fit entirely in memory.