UNIT –III

TWO MARKS

1. Define Dynamic Loading.

To obtain better memory-space utilization dynamic loading is used. With dynamic loading, a routine is not loaded until it is called. All routines are kept on disk in a relocatable load format. The main program is loaded into memory and executed. If the routine needs another routine, the calling routine checks whether the routine has been loaded. If not, the relocatable linking loader is called to load the desired program into memory.

2. Define Dynamic Linking.

Dynamic linking is similar to dynamic loading, rather that loading being postponed until execution time, linking is postponed. This feature is usually used with system libraries, such as language subroutine libraries. A stub is included in the image for each library-routine reference. The stub is a small piece of code that indicates how to locate the appropriate memory-resident library routine, or how to load the library if the routine is not already present.

3. What are Overlays?

To enable a process to be larger than the amount of memory allocated to it, overlays are used. The idea of overlays is to keep in memory only those instructions and data that are needed at a given time. When other instructions are needed, they are loaded into space occupied previously by instructions that are no longer needed.

4. Define Swapping.

A process needs to be in memory to be executed. However a process can be swapped temporarily out of memory to a backing store and then brought back into memory for continued execution. This process is called swapping.

5. What do you mean by Best Fit?

Best fit allocates the smallest hole that is big enough. The entire list has to be searched, unless it is sorted by size. This strategy produces the smallest leftover hole.

6. What do you mean by First Fit?

First fit allocates the first hole that is big enough. Searching can either start at the beginning of the set of holes or where the previous first-fit search ended. Searching can be stopped as soon as a free hole that is big enough is found.

7. How is memory protected in a paged environment?

Protection bits that are associated with each frame accomplish memory protection in a paged environment. The protection bits can be checked to verify that no writes are being made to a read-only page.

8. What is External Fragmentation?

External fragmentation exists when enough total memory space exists to satisfy a request, but it is not contiguous; storage is fragmented into a large number of small holes.

9. What is Internal Fragmentation?

When the allocated memory may be slightly larger than the requested memory, the difference between these two numbers is internal fragmentation.

10. What do you mean by Compaction?

Compaction is a solution to external fragmentation. The memory contents are shuffled to place all free memory together in one large block. It is possible only if relocation is dynamic, and is done at execution time.

11. What are Pages and Frames?

Paging is a memory management scheme that permits the physical-address space of a process to be non-contiguous. In the case of paging, physical memory is broken into fixed-sized blocks called frames and logical memory is broken into blocks of the same size called pages.

12. What is the use of Valid-Invalid Bits in Paging?

When the bit is set to valid, this value indicates that the associated page is in the process's logical address space, and is thus a legal page. If the bit is said to invalid, this value indicates that the page is not in the process's logical address space. Using the valid-invalid bit traps illegal addresses.

13. What is the basic method of Segmentation?

Segmentation is a memory management scheme that supports the user view of memory. A logical address space is a collection of segments. The logical address consists of segment number and offset. If the offset is legal, it is added to the segment base to produce the address in physical memory of the desired byte.

14. A Program containing relocatable code was created, assuming it would be loaded at address 0. In its code, the program refers to the following addresses: 50,78,150,152,154. If the program is loaded into memory starting at location 250, how do those addresses have to be adjusted?

All addresses need to be adjusted upward by 250.So the adjusted addresses would be 300, 328, 400, 402, and 404.

15. What is Virtual Memory?

Virtual memory is a technique that allows the execution of processes that may not be completely in memory. It is the separation of user logical memory from physical memory. This separation provides an extremely large virtual memory, when only a smaller physical memory is available.

16. What is Demand Paging?

Virtual memory is commonly implemented by demand paging. In demand paging, the pager brings only those necessary pages into memory instead of swapping in a whole process. Thus it avoids reading into memory pages that will not be used anyway, decreasing the swap time and the amount of physical memory needed.

17. Define Lazy Swapper.

Rather than swapping the entire process into main memory, a lazy swapper is used. A lazy swapper never swaps a page into memory unless that page will be needed.

18. What is a Pure Demand Paging?

When starting execution of a process with no pages in memory, the operating system sets the instruction pointer to the first instruction of the process, which is on a non-memory resident page, the process immediately faults for the page. After this page is brought into memory, the process continues to execute, faulting as necessary until every page that it needs is in memory. At that point, it can execute with no more faults. This schema is pure demand paging.

19. Define Effective Access Time.

Let p be the probability of a page fault (0£p£1). The value of p is expected to be close to 0; that is, there will be only a few page faults. The effective access time is,

Effective access time = (1-p) * ma + p * page fault time.

ma : memory-access time

20. Define Secondary Memory.

This memory holds those pages that are not present in main memory. The secondary memory is usually a high speed disk. It is known as the swap device, and the section of the disk used for this purpose is known as swap space.

21. What is the basic approach of Page Replacement?

If no frame is free is available, find one that is not currently being used and free it. A frame can be freed by writing its contents to swap space, and changing the page table to indicate that the page is no longer in memory. Now the freed frame can be used to hold the page for which the process faulted.

22. What is the various Page Replacement Algorithms used for Page Replacement?

- FIFO page replacement
- Optimal page replacement
- LRU page replacement
- LRU approximation page replacement
- Counting based page replacement
- Page buffering algorithm.

23. What are the major problems to implement Demand Paging?

The two major problems to implement demand paging is developing,

- Frame allocation algorithm
- Page replacement algorithm

24. What is a Reference String?

An algorithm is evaluated by running it on a particular string of memory references and computing the number of page faults. The string of memory reference is called a reference string.

FIFTEEN MARKS

1. Explain Dynamic Storage-Allocation Problem

- ***First-fit:*** Allocate the first hole that is big enough.
- ***Best-fit:*** Allocate the smallest hole that is big enough; must search entire list, unless ordered by size. Produces the smallest leftover hole.
- ***Worst-fit:*** Allocate the largest hole; must also search entire list. Produces the largest leftover hole.

First-fit and best-fit is better than worst-fit in terms of the speed and storage utilization.

2. Explain about Fragmentation

Fragmentation

- ✓ External Fragmentation – total memory space exists to satisfy a request, but it is not contiguous.
- ✓ Internal Fragmentation – allocated memory may be slightly larger than requested memory; this size difference is memory internal to a partition, but not being used.

- Reduce external fragmentation by compaction
- Shuffle memory contents to place all free memory together in one large block.
- Compaction is possible only if relocation is dynamic, and is done at execution time.
- I/O problem

3. Explain the concept of Paging

Basic method

- Logical address space of a process can be noncontiguous; process is allocated physical memory whenever the latter is available.
- Divide physical memory into fixed-sized blocks called frames (size is power of 2, between 512 bytes and 8192 bytes).
- Divide logical memory into blocks of same size called pages.

- Keep track of all free frames.
- To run a program of size n pages, need to find n free frames and load program.
- Set up a page table to translate logical to physical addresses.
- Internal fragmentation.

Address Translation Scheme

Address generated by CPU is divided into:

- Page number (p) – used as an index into a page table which contains base address of each page in physical memory.
- Page offset (d) – combined with base address to define the physical memory address that is sent to the memory unit.

4. Explain the types of Page Table Structure

- Hierarchical Paging
- Hashed Page Tables
- Inverted Page Tables

5. Explain about Segmentation in detail.

Basic method

- Memory-management scheme that supports user view of memory

Segmentation Architecture

- Logical address
- Segment table
- ✓ Base
- ✓ Limit
- ✓ Segment-table base register (STBR)
- ✓ Segment-table length register (STLR)
- ✓ Relocation.

Sharing

- Shared segments
- Same segment number

Allocation

- First fit/best fit
- external fragmentation

Protection With each entry in segment table associate:

- Validation bit = 0 ⇒ illegal segment
- Read/write/execute privileges

Protection bits associated with segments; code sharing occurs at segment level.
Since segments vary in length, memory allocation is a dynamic storage-allocation problem.
A segmentation example is shown in the following diagram.