**Assignment 2**

**Operating System (BCAC-0022)**

**BCA 2nd Year**

1. Discuss Define caching in the context of computer programming.

## Write the characteristics of Cache Memory.

1. Write Characteristics and importance of the Memory Hierarchy.
2. What is Memory Allocation in an OS, and why is it important?
3. What is Contiguous Allocation? Write the advantages and disadvantages.
4. Write the differences b/w Contiguous and Non-contiguous Allocation.
5. What is Fragmentation, Explain with its types.
6. Give arguments to support variable partitioning for main memory management.
7. Describe first-fit, best-fit, and worst-fit strategies for disk space allocation, with their merits and demerits.
8. What is a page and what is a frame. How are the two related?
9. Discuss virtual memory management schemes. Compare any two page replacement policies.
10. What is thrashing? When does it happen and how does it affect performance?
11. What is a page fault? What action does the OS take when a page fault occurs?
12. Compare and contrast the paging with segmentation. In particular, describe issues related to fragmentation.
13. Consider six memory partitions of size 200 KB, 400 KB, 600 KB, 500 KB, 300 KB and 250 KB. These partitions need to be allocated to four processes of sizes 357 KB, 210 KB, 468 KB and 491 KB in that order.

Perform the allocation of processes using:

First Fit Algorithm

Best Fit Algorithm

Worst Fit Algorithm

1. Consider six memory partitions of size 50 KB, 150 KB, 300 KB, 350 KB, 600 KB. These partitions need to be allocated to four processes of sizes 300 KB, 25 KB, 125 KB and 50 KB in that order.

Perform the allocation of processes using:

First Fit Algorithm

Best Fit Algorithm

Worst Fit Algorithm

1. Calculate the size of memory if its address consists of 32 bits and the memory is 2-byte addressable.
2. Calculate the number of bits required in the address for memory having size of 16 GB. Assume the memory is 4-byte addressable.
3. Consider a system with byte-addressable memory, 32 bit logical addresses, 4 kilobyte page size and page table entries of 4 bytes each. Calculate the size of the page table in the system in megabytes.
4. Consider a machine with 64 MB physical memory and a 32 bit virtual address space. If the page size is 4 KB, what is the approximate size of the page table?
5. In a virtual memory system, the size of virtual address is 32-bit, size of physical address is 30-bit, page size is 4 Kbyte and size of each page table entry is 32-bit. The main memory is byte addressable. Which one of the following is the maximum number of bits that can be used for storing protection and other information in each page table entry?
6. Consider a single level paging scheme. The virtual address space is 4 MB and page size is 4 KB. What is the maximum page table entry size possible such that the entire page table fits well in one page?
7. Consider a single level paging scheme. The virtual address space is 256 MB and page table entry size is 4 bytes. What is the minimum page size possible such that the entire page table fits well in one page?
8. A certain computer system has the segmented paging architecture for virtual memory. The memory is byte addressable. Both virtual and physical address spaces contain **216** bytes each. The virtual address space is divided into 8 non-overlapping equal size segments. The memory management unit (MMU) has a hardware segment table, each entry of which contains the physical address of the page table for the segment. Page tables are stored in the main memory and consist of 2 byte page table entries. What is the minimum page size in bytes so that the page table for a segment requires at most one page to store it?
9. Considering problem-24, give the division of virtual addresses.
10. Consider the following segment table-

Segment No. Base Length

0 1219 700

1 2300 14

2 90 100

3 1327 580

4 1952 96

Generate the physical address corresponding to following logical address:

1. 0, 430
2. 1, 11
3. 2, 100
4. 3, 425
5. 4, 95

**27.** A single processor system has three resource types X, Y and Z, which are shared by three processes. There are 5 units of each resource type. Consider the following scenario, where the column alloc denotes the number of units of each resource type allocated to each process, and the column request denotes the number of units of each resource type requested by a process in order to complete execution. Which of these processes will finish LAST?

1. P0
2. P1
3. P2
4. None of the above since the system is in a deadlock

Alloc Request

\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_

X Y Z X Y Z

P0 1 2 1 1 0 3

P1 2 0 1 0 1 2

P2 2 2 1 1 2 0

**28.** An operating system uses the banker’s algorithm for deadlock avoidance when managing the allocation of three resource types X, Y and Z to three processes P0, P1 and P2. The table given below presents the current system state. Here, the Allocation matrix shows the current number of resources of each type allocated to each process and the Max matrix shows the maximum number of resources of each type required by each process during its execution.

Allocation Max

\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_

X Y Z X Y Z

P0 0 0 1 8 4 3

P1 3 2 0 6 2 0

P2 2 1 1 3 3 3

REQ1: P0 requests 0 units of X, 0 units of Y and 2 units of Z

REQ2: P1 requests 2 units of X, 0 units of Y and 0 units of Z

Which of the following is TRUE?

1. Only REQ1 can be permitted
2. Only REQ2 can be permitted
3. Both REQ1 and REQ2 can be permitted
4. Neither REQ1 nor REQ2 can be permitted

**29.** A system has 4 processes and 5 allocatable resource. The current allocation and maximum needs are as follows-

Allocated Maximum

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

A 1 0 2 1 1 1 1 2 1 3

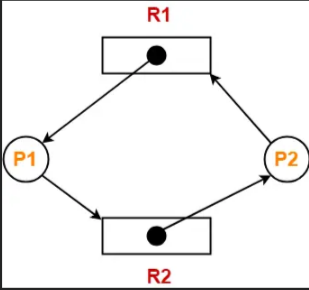
B 2 0 1 1 0 2 2 2 1 0

C 1 1 0 1 1 2 1 3 1 1

D 1 1 1 1 0 1 1 2 2 0

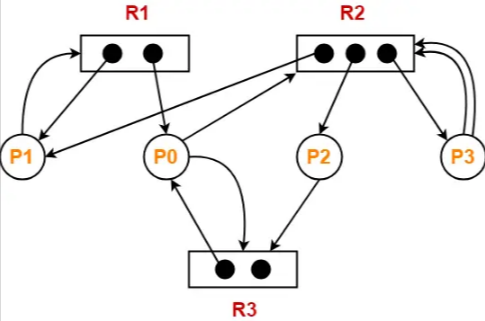
If Available = [ 0 0 X 1 1 ], what is the smallest value of x for which this is a safe state?

**30.** Consider the resource allocation graph in the figure-



Find if the system is in a deadlock state otherwise find a safe sequence.

**31.** Consider the resource allocation graph in the figure-



Find if the system is in a deadlock state otherwise find a safe sequence.

**32.** A system has 3 user processes each requiring 2 units of resource R. The minimum number of units of R such that no deadlock will occur-

3

5

4

6

**33.** A system has 10 user processes each requiring 3 units of resource R. The minimum number of units of R such that no deadlock will occur \_\_\_\_\_?

**34.** If there are 6 units of resource R in the system and each process in the system requires 2 units of resource R, then how many processes can be present at maximum so that no deadlock will occur?

**35.** If there are 6 units of resource R in the system and each process in the system requires 3 units of resource R, then how many processes can be present at maximum so that no deadlock will occur?

**36.** Consider the following page reference string with no. of frames are 3:

5, 0, 1, 0, 2, 3, 0, 2, 4, 3, 3, 2, 0, 2, 1, 2, 7, 0, 1, 1, 0

Analyze the system performance using all the page replacement algos i.e. FIFO, LRU, and Optimal.

**37.** Discuss about Belady’s Anomaly using proper example.

**38.** Write advantages and disadvantages of each Page Replacement Algorithm.

**39.** Given page reference string:

1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6

Compare the number of page faults for LRU, FIFO and Optimal page replacement algorithm with no. of frames 4.

**40.** Consider a disk queue with requests for I/O to blocks on cylinders 98, 183, 41, 122, 14, 124, 65, 67. The head is initially at cylinder number 53. The cylinders are numbered from 0 to 199. Find the total no. of head movement (in number of cylinders) incurred while servicing these requests using each Disk Scheduling Algorithm.

**41.** Suppose the order of requests are 70, 140, 50, 125, 30, 25, 160 and the initial position of the Read-Write head is 60. The cylinders are numbered from 0 to 170. Find the total no. of head movement (in number of cylinders) incurred while servicing these requests using each Disk Scheduling Algorithm.

**42.** Consider a disk pack with the following specifications- 16 surfaces, 128 tracks per surface, 256 sectors per track and 512 bytes per sector.

Answer the following questions-

1. What is the capacity of the disk pack?
2. What is the number of bits required to address the sector?
3. If the format overhead is 32 bytes per sector, what is the formatted disk space?
4. If the format overhead is 64 bytes per sector, how much amount of memory is lost due to formatting?
5. If the diameter of the innermost track is 21 cm, what is the maximum recording density?
6. If the diameter of the innermost track is 21 cm with 2 KB/cm, what is the capacity of one track?
7. If the disk is rotating at 3600 RPM, what is the data transfer rate?
8. If the disk system has a rotational speed of 3000 RPM, what is the average access time with a seek time of 11.5 msec?

**43.** What is the average access time for transferring 512 bytes of data with the following specifications: Average seek time = 5 msec, Disk rotation = 6000 RPM

Data rate = 40 KB/sec, Controller overhead = 0.1 msec

**44.** A certain moving arm disk storage with one head has the following specifications:

Number of tracks per surface = 200

Disk rotation speed = 2400 RPM

Track storage capacity = 62500 bits

Average latency = P msec

Data transfer rate = Q bits/sec

What is the value of P and Q?

**45.** A disk pack has 19 surfaces and storage area on each surface has an outer diameter of 33 cm and inner diameter of 22 cm. The maximum recording storage density on any track is 200 bits/cm and minimum spacing between tracks is 0.25 mm. Calculate the capacity of the disk pack.

**46.** Discuss about File Access methods in OS.

**47.** Discuss about File system implementation issues.

**48.** Discuss about Protection and Security in Operating Systems.

**49.** Discuss about Pipes and Filters in Shell Script.

**50.** Discuss about RAID.