**Part A: Multiple Choice Questions (MCQs)**

1. The page size and frame size
2. should be equal (c) need not be equal
3. page size > frame size (d) frame size > page size
4. In paged memory systems if the page size is increased then the internal fragmentation generally
5. becomes less (b) becomes more (c) remains constant (d) none of these
6. An address generated by the CPU is commonly referred to as
7. logical address (b) relational address (c) physical address (d) virtual address
8. Where does the Swap space reside?
9. RAM (b) Disk (c) ROM (d) On chip cache
10. Moving process from main memory to disk called
11. Scheduling (b) caching (c) Swapping (d)Spooling
12. The problem of fragmentation arises in
13. static storage allocation (c) stack allocation of storage
14. stack allocation with dynamic binding (d) heap allocation
15. With segmentation, if there are 64 segments and maximum segment size is 512 words, the length of bits in logical address is
16. 12 (b) 14 (c) 15 (d) 16
17. Swapping
18. works best with small partition
19. allows many programs to use memory simultaneously
20. does not work with overlaying
21. allows each program in turn to use the memory
22. Dynamic linking can cause security concerns because
23. Security is dynamic
24. The path for searching dynamic libraries is not known till runtime
25. Linking is insecure
26. Cryptographic procedures are not available for dynamic linking
27. Consider a machine with 64 MB physical memory and a 32-bit virtual address space. If the page size is 4KB, what is the approximate size of the page table?
28. 16 MB (b) 8 MB (c) 2 MB (d) 24 MB
29. Fixed partition memory allocation supports

a) Multiprogramming b) Uniprogramming

c) Both of these d) none of these

1. Variable partition memory allocation can lead to

a) External fragmentation b) Internal fragmentation

c) Both of these d) none of these

1. Virtual memory concept is supported by

a) demand paging b) simple segmentation

c) simple page allocation d) both (a) and (c)

1. Virtual memory means

a) the job size is not bounded by the physical memory limit

b) the job size is bounded by the physical memory limit

c) independent of physical memory limit

d) none of these.

1. Page fault occurs when
2. the page in corrupted by application software
3. the page is not in main memory
4. the page is in main memory
5. one tries to divide a number by 0.
6. Page stealing is
7. A sign of efficient system
8. Taking larger disk spaces for paged out
9. Taking page frames from other working sets
10. One of the tuning goals.
11. Virtual memory is

. a) An extremely large main memory

b) An extremely large secondary memory

c) An illusion of an extremely large memory

d) A type of memory used in super computer.

1. Thrashing
2. reduces page I/O (c) decreases the degree of multiprogramming
3. implies excessive page I/O (d) improve the system performance
4. In which of the storage placement strategies a program is placed the target available hole in the main memory
5. best fit (b) first fit (c) worst fit (d) buddy
6. If an instruction takes i microseconds and a page fault takes an additional j microseconds, the effective instruction time if on the average a page fault occurs every k instruction is:
7. i + j/k (b) i + j \* k (c) (i + j)/k (d) (i+j)\*k

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1. In a system with 32 bit virtual addresses and 1KB page size, use of one-level page tables for virtual to physical address translation is not practical because of
2. the large amount of internal fragmentation
3. the large amount of external fragmentation
4. the large memory overhead in maintaining page tables
5. the large computation overhead in the translation process
6. The minimum number of page frames that must be allocated to a running process in a virtual memory environment is determined by
7. the instruction set architecture (c) page size
8. physical memory size (d) number of processes in memory
9. The main memory size is assumed to be 4KB and the page size is 1KB. If LRU (Least Recently Used) algorithm is used for page replacement then what pages should reside in main memory at the end for the following sequence of page references ? 4, 8, 2, 3, 2, 8, 3, 1, 2, 6, 7
10. 1,6,2,7 (b) 2, 4, 7, 8 (c) 1, 2, 6, 7 (d) 1, 2, 3, 8
11. In a virtual memory system, size of virtual address is 32bit, 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?
12. 2 (b) 10 (c) 12 (d) 14
13. A process refers to 5 pages in the following order A, B, C, D, A, B, E, A, B, C, D, E. If the page replacement is FIFO, number of page transfer with initial 3 frames is
14. 8 (b) 10 (c) 9 (d) 7
15. For question no 39, if the number of available page frame is increased to 4 , then the
16. Page fault decreases (c) Page fault increases
17. Same as before (d) None of these.
18. Belady's anomaly reflects the fact that in some page replacement algorithms, page fault rate\_\_\_\_\_\_ as number of allocated frames\_\_\_\_\_\_\_\_\_\_\_.
19. increases, decreases (c) increases, increases
20. decreases, increases (d) decreases, decreases
21. A process refers to 5 pages in the following order A, B,C,D,A,B,E,A,B,C,D,E. If page replacement is FIFO, number of page transfer with initial 3 frames is:
22. 8 (b) 10 (c) 9 (d) 7
23. The correct matching for the following pairs is

(A) DMA I/O (1) High speed RAM

(B) Cache (2) Disk

(C) Interrupt I/O (3) Printer

(D) Condition Code Register (4) ALU

1. A - 4 B - 3 C - 1 D – 2 (c) A - 2 B - 1 C - 3 D – 4
2. A - 4 B - 3 C - 2 D – 1 (d) A - 2 B - 3 C - 4 D - 1
3. The correct matching for the following pairs is:

(A) Disk scheduling (1) Round robin

(B) Batch processing (2) SCAN

(C) Time sharing (3) LIFO

(D) Interrupt processing (4) FIFO

1. A - 3 B - 4 C - 2 D – 1 (c) A - 4 B - 3 C - 2 D - 1
2. A - 2 B - 4 C - 1 D - 3 (d) A - 3 B - 4 C - 3 D - 2
3. I/O redirection
4. implies changing the name of a file
5. can be employed to use an existing file as input file for a program
6. implies connection 2 programs through a pipe
7. None of the above
8. When an interrupt occurs, an operating system
9. ignores the interrupt
10. always changes state of interrupted process after processing the interrupt
11. always resumes execution of interrupted process after processing the interrupt
12. may change state of interrupted process to ”blocked‘ and schedule another process
13. If the read/write head of a disk starts at track 100 and the disk has requests pending to tracks 43, 158, 44, 203 and 175, what is the total number of tracks that the read/write head will cross to satisfy these requests under the following disk scheduling technique?

(A) FCFS (1) 263 tracks

(B) SSTF (2) 473 tracks

(C) LOOK (3) 217 tracks

1. A-2 B-3 C-1 (b) A-2 B-1 C-3 (c) A-1 B-2 C-3 (d) none
2. A disk has 200 tracks (numbered 0 through 199). At a given time, it was servicing the request of reading data from track 120, and at the previous request, service was for track 90. The pending requests (in order of their arrival) are for track numbers. 30 70 115 130 110 80 20 25.

How many times will the head change its direction for the disk scheduling policies SSTF (Shortest Seek Time First) and FCFS (First Come First Serve)?

1. 2 and 3 (b) 3 and 3 (c) 3 and 4 (d) 4 and 4

**Part B**

1. Why page are sizes always powers of 2? What is the difference between logical and physical addresses? [WBUT – 09]
2. What are the advantages and disadvantages of having unequal size partitions in fixed partition scheme? [WBUT – 09]
3. What are the two major differences between segmentation and paging ?
4. How is paging implemented in hardware ?
5. What is the problem of fragmentation and how it can be solved ?
6. Give details of how paging is implemented in hardware. Explain what is a Translation Lookaside Buffer (TLB) and give details of how it is implemented.
7. What is the difference between logical address and physical address ?
8. What is fragmentation ? How is external fragmentation solved ?
9. What is compaction ? What are the drawbacks of compaction ?
10. What is effective memory access time ? A paging system with the table stored in the memory.
11. What are the two major differences between segmentation and paging ?
12. How is paging implemented in hardware ?
13. Draw the diagram of paging hardware with TLB.
14. Discuss the address translation in the two-level paging.
15. Describe the actions taken by the operating system when a page fault occurs.
16. Give details of how paging is implemented in hardware.
17. Explain what a Translation Lookaside Buffer (TLB) is and give details of how it works.
18. What is internal fragmentation ?
19. When does Page fault occur?
20. Explain what is Contiguous Allocation of file space on disk. What are the advantages and disadvantages of contiguous allocation ?
21. Explain how a File Allocation Table ( FAT ) is implemented.
22. Briefly explain different free space management techniques. [WBUT – 2010]

**Part C**

1. A hard disk with a transfer rate of 10 MB/Sec is constantly transferring data to memory using DMA. The processor runs at 600 MHz, and takes 300 and 900 clock cycles to initiate and complete DMA transfer respectively. If the size of the transfer is 20 KB, what is the percentage of processor time consumed for the transfer operation?
2. What problems could occurs if a system allowed a file system to be mounted simultaneously at more than one location.
3. An instruction takes 1 microsecond and a page fault takes an additional n microsecond. What will be the average instruction time, if every k instruction is a page fault.
4. Given a memory partition of 100K, 500K, 200K, 300K and 600K in order. How would each of the first-fit,best-fit,worst-fit algorithms place processes of 212K,417K,112K and 426K in order? Which algorithm makes the most efficient use of memory?
5. Consider the following segment table:

Segment Base Limit

0 219 600

1 2300 14

2 90 100

3 1327 580

4 1952 96

What are the physical addresses for the following logical addresses?

1. 0, 430
2. 1, 10
3. 2, 500
4. 3, 400
5. 4, 112
6. The main memory size is assumed to be 4 KB and the page size is 1 KB. If LFU (Least Frequently Used) algorithm is used for page replacement then what pages should reside in main memory at the end of the following sequence of page references. 4, 8, 2, 3, 2, 8, 3, 1, 2, 6,
7. An instruction takes 1 microsecond and a page fault takes an additional n microsecond. What will be the average instruction time, if every k instruction is a page fault
8. Consider a system with a two-level paging scheme in which a regular memory access takes 150 nanoseconds, and servicing a page fault takes 8 milliseconds. An average instruction takes 100 ns of CPU time, and two memory access. The TLB hit ratio is 90%, and the page fault rate is one in every 10000 instructions. What is the effective average instruction execution time?
9. What is the data transfer rate in MB/s and average access time for a Hard disk having capacity 100 MB? It has 18 storage surfaces with number of tracks per surface 600. Disk speed is 3000 rpm and average seek time is 25ms.
10. Given that it takes 1 ms to travel from one track to the next, and that the arm is originally positioned at track 15 moving toward the low-numbered tracks. Compute how long it will take to satisfy the following requests 4, 40, 11, 35, 7, 14. Use the SCAN scheduling policy and ignore rotational time and transfer time; just consider seek time).

(a) Consider a system with a 32-bit logical address space, a two-level paging scheme, 4 byte page table entries, 1 KB pages, and a 4 entry TLB. The page-table base register access time is 0 ns, TLB access is 10 ns and memory access time is 100 ns

i) How many address bits are needed for the page offset?

ii) How much memory in bytes is required to store the outer page table entirely in main memory?

(b) What is effective memory access time?

1. A paging system with the table stored in the memory.
   1. If memory reference takes 200 ns, how long does a paged memory reference take?
   2. If we add TLBs and 75% hit is successful. What is the effective memory reference time? (Assume that finding page-table entry in the TLBs take zero time, if the entry is there.)
2. (a) Consider the following page reference string :

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

How many page faults would occur for the following replacement Algorithms? Assuming 3 frames are available. Also assume that initially none of pages in main memory.

1. Optimal replacement
2. FIFO replacement.

(b) Which replacement strategy in the above performs better and why ?

1. Given references to the following pages by a program.

0, 9, 0, 1, 8, 1, 8, 7, 8, 7, 1, 2, 8, 2, 7.

How many page faults will occure if the program has three (3) page Frames available to it and uses both FIFO replacement strategy and LRU replacement strategy. Which replacement strategy in the above performs better and why?

1. A program’s logical memory has been divided into 7 pages and these pages are given frame numbers 4, 10, 3, 7, 6, 8, and 2 sequentially. Show the logical memory mapping to the physical memory.
2. Suppose a disk drive has 300 cylinders, numbered 0 to 299. The current head position of the disk is at 90, the queue of pending requests,in FIFO order is 36, 79, 15, 120, 199, 270,89,170. Calculate the average cylinder movements for Shortest Seek Time First (SSTF) algorithm. Mention any one disadvantage of SSTF.
3. If the size of each data block is 512 bytes in Unix file system, assuming the size of a pointer is 4 bytes. Find the maximum size of a file when Inode block contain 10 direct pointers. 1 single indirect pointer, 1 double indirect pointer and 1 triple indirect pointer.

**Part D**

**MEMORY MANAGEMENT**

1. Name the functions constituting the OS's memory management. [M/T: 2/4]
2. Name two differences between logical and physical addresses. [M/T: 2/4]
3. Relate page and frame with virtual memory and physical memory. [M/T: 2/5]
4. What is the role of Memory-Management Unit (MMU)? [M/T: 2/4]
5. Where swap space is resides? [M/T: 2/4]
6. Define lazy swapper. [M/T: 3/4]
7. In what way relocation register helps? [M/T: 2/4]
8. In fixed sized partition, how you can define the degree of multiprogramming? [M/T: 2/4]
9. Explain the difference between internal fragmentation and external fragmentation. Which one occurs in paging system? [M/T: 2/4]
10. How the problem of external fragmentation be solved? [M/T: 2/4]
11. When a process is rolled out of memory, it loses its ability to use the CPU(at least for a while).

[M/T: 2/4]

1. Describe another situation where a process loses its ability to use theCPU, but where the process does not get rolled out. [M/T: 2/4]
2. Why are pages sizes always powers of 2? [M/T: 2/4]
3. Why are segmentation and paging sometimes combined into one scheme? [M/T: 2/4]
4. Describe a mechanism by which one segment could belong to the address space of two different processes. [M/T: 3/7]
5. Explain why it is easier to share a reentrant module using segmentation than it is to do so when pure paging is used. [M/T: 2/4]
6. Name the different types of memory? [M/T: 2/4]
7. Throw some light on Internal Process Memory. [M/T: 2/4]
8. Explain compaction. [M/T: 2/4]
9. What are page frames? [M/T: 2/4]
10. What are pages? [M/T: 2/4]
11. Differentiate between logical and physical address. [M/T: 2/4]
12. The offset ‘d’ of the logical address must be between 0 and segment limit Explain? [M/T: 2/4]
13. When does page fault error occur? [M/T: 2/4]
14. What is overlay? [M/T: 2/4]
15. Explain thrashing. [M/T: 2/4]
16. What is root partition? [M/T: 2/4]
17. What is the purpose of modify bit in page table? [M/T: 2/4]
18. Paging and segmentation are sometimes combined with one scheme. Why?
19. Discuss situations in which the most frequently used page-replacement algorithm generates fewer page faults than the least recently used page-replacement algorithm.

**VIRTUAL MEMORY**

1. Under what circumstances do page faults occur? [M/T: 2/4]
2. Describe the actions taken by the operating system when a page fault occurs. [M/T: 3/8]
3. Let a program size 10GB and RAM 1GB. Whether the program can be executed in that system or not.
4. When virtual memory is implemented in a computing system, there are certain costs associated with the technique and certain benefits. List the costs and the benefits. Is it possible for the costs to exceed the benefits? If it is, what measures can be taken to ensure that this does not happen? [M/T: 3/7]
5. When the entries in the segment tables of two different processes point to the same physical location. [M/T: 2/4]
6. How LRU can be implemented explain? [M/T: 3/5]
7. Explain Belady’s anomaly. [M/T: 3/6]
8. We have an operating system for a machine that uses base and limit registers, but we have modified the machine to provide a page table. Can the page tables be set up to simulate base and limit registers? How can they be, or why can they not be? [M/T: 3/7]
9. A multilevel page table is preferred in comparison to a single level page table for translating virtual address to physical address Explain. [M/T: 2/5]
10. What is thrashing? Why does it occur?
11. What is the cause of thrashing? How does the system detect thrashing? Once it detects thrashing, what can the system do to eliminate this problem? [M/T: 3/7]
12. Let a program size 10GB and RAM 1GB. Whether the program can be executed in that system or not. [M/T: 2/3]
13. What is the advantage of dynamic loading? [M/T: 2/3]
14. What is dynamic linking? [M/T: 3/4]
15. What is shared libraries? [M/T: 2/3]
16. Mention the binding steps. [M/T: 3/4]
17. What is address binding? [M/T: 2/3]
18. What are the common strategies used to select a free hole? [M/T: 3/4]
19. What is a reference string? [M/T: 2/3]
20. What is the usage of inverted page table? [M/T: 3/4]

**FILE SYSTEMS**

1. What are the basic functions of file management in OS. [M/T: 3/7]
2. Consider a file system where a file can be deleted and its disk space reclaimed while links to that file still exist. What problems may occur if a new file is created in the same storage area or with the same absolute path name? How can these problems be avoided? [M/T: 3/7]
3. Some systems automatically delete all user files when a user logs off or a job terminates, unless the user explicitly requests that they be kept; other systems keep all files unless the user explicitly deletes them. Discuss the relative merits of each approach. [M/T: 3/7]
4. What are the advantages and disadvantages of recording the name of the creating program with the file’s attributes (as is done in the Macintosh Operating System)? [M/T: 3/7]
5. Consider a system that supports 5000 users. Suppose that you want to allow 4990 of these users to be able to access one file.
6. How would you specify this protection scheme in UNIX? [M/T: 2/5]
7. Could you suggest another protection scheme that could be used more effectively for this purpose than the scheme provided by UNIX? [M/T: 3/7]
8. In what situations would use memory as a RAM disk be more useful than using it as a disk cache? [M/T: 2/5]
9. How do caches help improve performance? Why do systems not use more or larger caches if they are so useful? [M/T: 3/7]
10. What are the different accessing methods of a file? [M/T: 2/3]
11. What are the various layers of a file system? [M/T: 3/4]
12. What is meant by Text File? [M/T: 2/3]
13. What is meant by Source File? [M/T: 2/3]
14. What is meant by Object File? [M/T: 2/3]
15. What is meant by Executable file? [M/T: 2/3]
16. What are the Access methods available? [M/T: 2/3]
17. What are the various operations performed in a File? [M/T: 2/3]
18. What are the operations performed in a Directory? [M/T: 2/3]
19. What are the different directory structures available? [M/T: 2/3]
20. What is meant by Boot Control block? [M/T: 2/3]
21. What is meant by Partition Control Block? [M/T: 2/3]
22. What are the different methods for allocation in a File System? [M/T: 2/3]
23. What is meant by Free Space List? [M/T: 2/3]
24. What is meant by Buffering? [M/T: 2/3]
25. What is Double Buffering? [M/T: 2/3]
26. What are File Attributes? [M/T: 2/3]
27. What is meant by Identifier in Files? [M/T: 2/3]
28. What is the native/default file system forma for Windows XP. [M/T: 1/2]
29. What is NTFS? [M/T: 1/2]

**DISK SCHEDULING**

1. What is the role of disk and host controller? [M/T: 4/6]
2. What do you mean by disk bandwidth? [M/T: 2/3]

**I/O DEVICE**

1. What are the four register that an I/O port typically consists. [M/T: 3/5]
2. Explain the uses of bus? [M/T: 2/3]
3. What is the content of interrupt vector? [M/T: 2/3]
4. What is device driver? [M/T: 2/4]
5. What is spooling? [M/T: 2/4]
6. What is cycle stealing? [M/T: 2/4]
7. What is meant by Seek Time? [M/T: 2/4]
8. What is meant by Rotational Latency? [M/T: 2/4]
9. What is meant by Low-level formatting? [M/T: 2/4]
10. What is meant by Swap-Space Management? [M/T: 2/4]
11. What is meant by Disk Scheduling? [M/T: 2/4]
12. Why Disk Scheduling necessary? [M/T: 2/4]
13. What are the characteristics of Disk Scheduling? [M/T: 2/4]
14. What are the different types of Disk Scheduling? [M/T: 2/4]
15. What is meant by SSTF Scheduling? [M/T: 2/4]
16. What is meant by FCFS Scheduling? [M/T: 2/4]
17. What is meant by SCAN Scheduling? [M/T: 2/4]
18. What is meant by C-SCAN Scheduling? [M/T: 2/4]
19. Defying Throughput. [M/T: 2/4]
20. What is meant by Data Striping? [M/T: 2/4]
21. What is meant by Boot Disk? [M/T: 2/4]
22. What are the Components of a Linux System? [M/T: 2/4]
23. What is the main support for the Linux modules? [M/T: 2/4]