Type: MCQ

Q1. When translating a virtual address to a physical address, a multilevel page table is always a preference as compared to a single level page because it (0.5)

1. Helps in the reduction of the total page faults in the page replacement algorithms
2. Reduces the total memory access time for reading or writing a memory location
3. ** Helps in the reduction of the page table size required for implementing a process's virtual address space
4. Is required by the lookaside buffer translation

Q2. Consider paging hardware that has a TLB. Let us assume that the page table and the pages are in their physical memory. Searching the TLB takes 10 milliseconds, and accessing the physical memory takes 80 milliseconds. In case the TLB hit ratio is 0.6, then the effective memory access time is _________ (in milliseconds). (0.5)

1. 124
2. **122
3. 120
4. 118.

Q3. A total of 9 units of a resource type available and safe state, which of the following sequence will be a safe state ? (0.5)

Process	Used	Max
P1	2	7
P2	1	6
P3	2	5
P4	1	4

1. P1, P3, P4, P2
2. P4, P2, P1, P3
3. P4, P2, P3, P1
4. **P3, P1, P2, P4.

Q4. On a system having a single processor using demand paged memory, it takes 200ns to satisfy a memory request if the page is in the memory. The system takes 7ms to check a free frame while 15ms if the page to be swapped out has been modified. What is the effective access time if the page fault rate is 5% with 60% of the time the page to be replaced has been modified? Assume the CPU is idle during page swaps and determine the answer in microseconds. (0.5)

1. ** 590.19 µs

2. 400.67 µs
3. 500.29 µs
4. 234.76 µs

Q5. What does Belady's anomaly refer to? (0.5)

1. Page faults increases as frames decreases in FIFO
2. Page faults decreases as frames increases in Optimal
3. Page faults increases as frames increases in FCFS
4. ** Page faults increases as frames increases in FIFO

Q6. A process refers to 5 pages, A, B, C, D, E in the order : A, B, C, D, A, B, E, A, B, C, D, E. If the page replacement algorithm is FIFO, the number of page transfers with an empty internal store of 3 frames is? (0.5)

1. ** 9
2. 8
3. 10
4. 7

Q7. A memory page containing a heavily used page that was initialized very early and is in constant use is removed, then the page replacement algorithm used is (0.5)

1. LRU
2. **FIFO
3. SJF
4. Optimal

Q8. Which of the following is not true with respect to deadlock prevention and deadlock avoidance scheme? (0.5)

1. **In deadlock prevention, the request for resource is always granted if resulting state is safe
2. In deadlock avoidance, the request for resource is always granted if resulting state is safe
3. Deadlock avoidance requires knowledge of resource requirements a priori
4. Deadlock prevention is more restrictive than deadlock avoidance

Q9. Solution to crirtical section problem using Peterson's solution is synchronization between (0.5)

1. 3 processes
2. **2 processes
3. Any number of processes
4. Only between 2 independent processes

Q10. A counting semaphore was initialized to 10. Then 6 P (wait) operations and 4 V (signal) operations were completed on this semaphore. The resulting value of the semaphore is___________ (0.5)

1. **8
2. 2
3. 6
4. 4

Type: DES

Q11. Consider the following table for process and resources

	Allocation	Max	Available
P0	1 1 2	4 3 3	2 1 0
P1	2 1 2	3 2 2	
P2	4 0 1	9 0 2	
P3	0 2 0	7 5 3	
P4	1 1 2	11 2 3	

a. Determine the total number of each resource type.
b. What is the need matrix?
c. Determine if this state is safe using safety algorithm (Show the steps). . (2)

Scheme: **(a) 0.5 Mark**
(b) 0.5 mark
(c) 1 mark

of an allocation state and dea...

(a) Total resource = total allocated(sum of columns of allocation + available
= [8 5 7] + [2 1 0] = [10 6 7]

(b) need = MAX – allocation

A B C –	*A B C* =	A B C
4 3 3	1 1 2	3 2 1
3 2 2	2 1 2	1 1 0
9 0 2	4 0 1	5 0 1
7 5 3	0 2 0	7 3 3
11 2 3	1 1 2	10 1 1

(c) Safety algorithm:

work = available = 2 1 0, finish = 00000
need1 = 1 1 0 < 2 1 0, finish = 01000, work = 2 1 0 + 2 1 2 = 4 2 2
need0 = 3 2 1 < 4 2 2, finish = 11000, work = 4 2 2 + 1 1 2 = 5 3 4
need2 = 5 0 1 < 5 3 4, finish = 11100, work = 5 3 4 + 4 0 1 = 9 3 5
need3 = 7 3 3 < 9 3 5, finish = 11110, work = 9 3 5 + 0 2 0 = 9 5 5
need4 > 10 1 1 > 9 5 5, no sequence is possible thus the state is unsafe.

(d) Use deadlock detect...

Q12. Consider a process with a reference page string as 2, 3, 2, 1, 5, 2, 4, 5, 3, 2, 5, 2. With 3 frames in the physical memory show the Optimal and LRU algorithm replacement policy. For each, also determine the number of page faults after the first three pages are placed in the frames. . (2)

Soln: OPT - 3 Page Faults

2	3	2	1	5	2	4	5	3	2	5	2
2	2	2	2	2	2	4	4	4	2	2	2
	3	3	3	3	3	3	3	3	3	3	3
			1	5	5	5	5	5	5	5	5
				F		F			F		

LRU - 4 Page Faults

2	3	2	1	5	2	4	5	3	2	5	2
2	2	2	2	2	2	2	2	3	3	3	3
	3	3	3	5	5	5	5	5	5	5	5
			1	1	1	4	4	4	2	2	2
				F		F		F	F		

Each illustration 0.5M and each count of page faults 0.5M

Q13. Give an example of deadlock and starvation among 3 processes while accessing 3 semaphores R, S and T whose values being set to 1. Write code snippet for bounded waiting mutual exclusion with test_and_set() . (3)

Deadlock where all 3 processes start with wait for R followed by S followed by T 1M

bounded waiting 2M

```
do{
    waiting[i] = TRUE;
    key = TRUE;
    while(waiting[i] && key)
        key = TestAndSet(&lock);
    waiting[i] = FALSE;

    // Critical Section

    j = (i + 1) % n;
    while ((j != i) && !waiting[j])
        j = (j+1) % n;

    if (j == i )
        lock = FALSE;
    else
        waiting[j] = FALSE;
    // Remainder Section
} while (TRUE);
```

2M

Q14. Consider a program consists of five segments: S0 = 600, S1 = 14 KB, S2= 100 KB, S3 =580 KB, and S4 = 96 KB. Assume at that time, the available free space partitions of memory are 1200–1805, 50 – 150, 220-234, and 2500-3180.

Find the following:

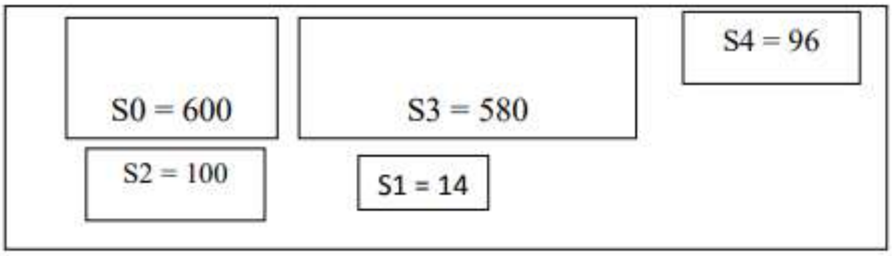
1. Draw logical to physical maps and segment table?

2. Allocate space for each segment in memory?

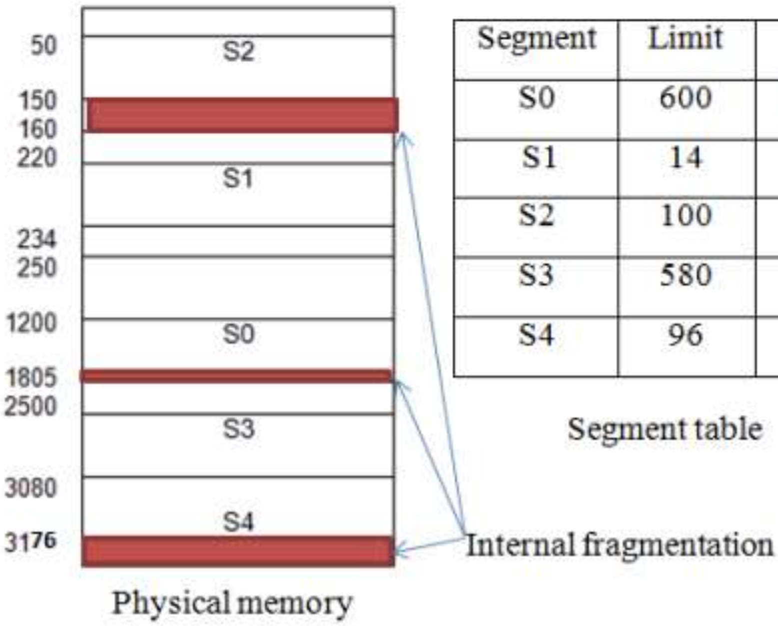
3. Calculate the external fragmentation and the internal fragmentation?

4. What are the addresses in physical memory for the logical addresses 0.580 and 1.17? . (3)

The logical map is:



Logical map



Physical memory

Segment	Limit	Base
S0	600	1200
S1	14	220
S2	100	50
S3	580	2500
S4	96	3080

Segment table

3. External fragmentation =0.

Internal fragmentation = (160-150) +(1805-1800) + (3180-3176) = 10 + 5 + 4 = 19

Fragmentation = external fragmentation + internal fragmentation = 0 + 19 = 19

4. The physical addresses are

a) 0.580 the physical address of 0.580 = 1200+580 = 1780.

b) 1.17 because d > limit of S1, the address is wrong.

(Segment Table:0.5M + Allocation:0.5M+External & Internal Fragmentation:1M + Physical Address:1M)