

**National Institute of Technology Mizoram**  
**Mid – Semester Examination, Odd Semester - 2021**  
**OPERATING SYSTEMS (CSL 1501)**

**5<sup>th</sup> Semester (BTech)**

**Full Marks: 15 marks**

**Duration: 1:00 hours**

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**Answer all the questions**

1. Consider two processes sharing the following variables:

```
boolean flag[2]; /* initially false */  
int turn;
```

The structure of process  $P_i$  ( $i == 0$  or  $1$ ) is shown below; the other process is  $P_j$  ( $j == 1$  or  $0$ ). Check whether the algorithm satisfies all three requirements for the critical-section problem. Give proper justification. [6]

```
do {  
    flag[i] = TRUE;  
  
    while (flag[j]) {  
        if (turn == j) {  
            flag[i] = false;  
            while (turn == j)  
                ; // do nothing  
            flag[i] = TRUE;  
        }  
    }  
  
    // critical section  
  
    turn = j;  
    flag[i] = FALSE;  
  
    // remainder section  
} while (TRUE);
```

P.T.O.

2. Explain how the following pairs conflict in certain settings [4]

A. CPU utilization and response time

B. I/O device utilization and CPU utilization

3. What is a process scheduler? State the characteristics of a good process scheduler? [3]

4. Give a scenario in which multithreading does not provide better performance than a single-threaded solution. [2]

~~~~~ Best of Luck!!! ~~~~~

**Operating Systems (CSL 1502)**

**End –Semester Assignment, Odd 2021**

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1. Consider the deadlock that can occur when the philosophers obtain the chopsticks one at a time in the dining philosophers problem. In this situation, discuss how the four necessary conditions for deadlock hold true. Discuss how any one of the four necessary conditions could be removed to avoid a deadlock. [5+5]
2. Consider a computer system with a 32-bit logical address and 4-KB page size. The system supports up to 512MB of physical memory. How many entries are there in each of the following? [3+3]
  - i. A conventional single-level page table
  - ii. An inverted page table
3. Consider a system using segmented paging architecture. The segment is divided into 1k pages, each of size 512 words. The segment table is divided into 1k pages each of size 256 words. The page table entries are 2 bytes in size. The frame number requires 18 bits to represent a frame. Calculate logical and physical address size and also the page table size for both the segment table and segment. [6]
4. Let the page fault service time be 10 ms. The average memory access time is 20 ns. If one page fault is generated per  $10^6$  instruction, then what is the effective memory access time? [4]
5. Why is rotational latency usually not considered in disk scheduling? [4]
6. In a disk system, the average seek time of is ns and the rotation rate is 3600 rpm. Each track has 512 sectors, each of size 2 kB. [5+5]
  - i. What is approximate time to read 1200 random sectors?
  - ii. What is data transfer rate?

**National Institute of Technology Mizoram**  
**Mid – Semester Examination, Odd Semester (2022-23)**  
**Operating Systems (CSL 1502)**

5<sup>th</sup> Semester

Full Marks: 30 marks

Duration: 1:30 hours

**Answer all 3 (Three) Questions. All Questions Carry Same Marks**  
**(3 \* 10 = 30 Marks)**

1. a) Explain the differences in how much the following scheduling algorithms discriminate in favor of short processes: [6]

- i. FCFS
- ii. RR
- iii. Multilevel feedback queues

b) Which of the following scheduling algorithms could result in starvation? Justify [4]

- i. First-come, first-served
- ii. Shortest job first
- iii. Round robin
- iv. Priority

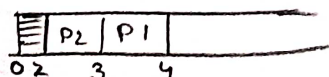
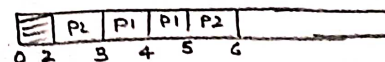
(OR)

c) Consider the following set of processes, and calculate waiting time and turnaround time for each of the processes, assuming they are being scheduled using the following CPU scheduling algorithms. [5+5]

| Process No. | A.T. | B.T. |
|-------------|------|------|
| ⊗ 1         | 3    | 2    |
| ⊗ 2         | 2    | 4    |
| 3           | 6    | 3    |
| ⊗ 4         | 8    | 1    |
| ⊗ 5         | 4    | 3    |
| ⊗ 6         | 5    | 4    |

i) Round Robin with time quantum = 2 units.

ii) Shortest Remaining Time First Scheduling.



1 2 5 6

2. a) Describe how the TestAndSet() instruction can be used to provide mutual exclusion that satisfies the bounded-waiting requirement. [10]

(OR)

b) Show that, if the wait() and signal() semaphore operations are not executed atomically, then mutual exclusion may be violated. [4]

✓c) Explain Dining Philosophers Problem and its solution. [6]

3. a) We can obtain the banker's algorithm for a single resource type from the general banker's algorithm simply by reducing the dimensionality of the various arrays by 1. Show through an example that we cannot implement the multiple-resource-type banker's scheme by applying the single-resource-type scheme to each resource type individually. [5]

b) Explain different methods to prevent deadlock. [5]

(OR)

✓c) Explain Process State Cycle with a diagram. [6]

d) Differentiate between Short-term and Mid-term schedule. [4]

~~~~~ Best of Luck ~~~~~



**National Institute of Technology Mizoram**  
**End – Semester Examination, Odd Semester (2022-23)**  
**Operating Systems (CSL 1502)**

5th Semester, B.Tech

Maximim Mark: 50

Time: 3 hrs

Answer all 5 (Five) Questions. All Questions Carry Same Marks

(5 \* 10 = 50 Marks)

1. (a) What are the main advantages of multiprogramming? [2]  
(b) What are the main differences between operating systems for mainframe computers and personal computers? [2]  
(c) Give four major activities of an operating system in regard to file management? [4]  
(d) Why are page sizes always powers of 2? [2]
2. (a) Given memory partitions of 100K, 500K, 200K, 300K, and 600K (in-order), how would each of the First-fit, Best-fit, and Worst-fit algorithms place processes of 212K, 417K, 112K, and 426K (in-order)? Which algorithm makes the most efficient use of memory? [10]

**OR**

- (b) What is Translation Look Aside Buffer (TLB)? Explain how logical address are mapped to physical address using TLB. [4]  
(c) Consider a computer system with a 32-bit logical address and 4KB page size. The system supports up to 512MB of physical memory. How many entries are there in each of the following? [3+3]
  - i. A conventional single-level page table
  - ii. An inverted page table

3. (a) What is segmented paging? How is it different form conventional paging. [4]  
(b) Consider a system using segmented paging architecture. The segment is divided into 1k pages, each of size 512 words. The segment table is divided into 1k pages each of size 256 words. The page table entries are 2 bytes in size. The frame number requires 18 bits to represent a frame. Calculate logical and physical address size and also the page table size for both the segment table and segment. [6]

**OR**

- (c) What is virtual memory? Explain the working of demand paging scheme with a diagram. [3 + 7]

4. (a) Consider the following page reference string:

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

How many page faults would occur for the following replacement algorithms, assuming one, two, three, four, and five frames? Remember all frames are initially empty, so your first unique pages will all cost one fault each.

[5 + 5]

- i. LRU replacement
- ii. Optimal replacement

OR

- (b) Describe frame allocation policies.

[4]

- (e) Explain SSTF (Shortest Seek Time First) and LOOK disk scheduling algorithms with examples.

[3 + 3]

- 4. ✓(a) In a disk system, the average seek time of is 60ns and the rotation rate is 3600 rpm. Each track has 512 sectors, each of size 2 kB.

[5+5]

- i. What is approximate time to read 1200 random sectors?
- ii. What is data transfer rate?

OR

- (b) How long does it take to load a 64K program from a disk whose rotation time is 20ms and the seek time is 30 ms. The track size is 32KB. Assume that the program is divided into pages each of size 2K and the pages are spread randomly on disk.

[10]

~~~~~ BEST OF LUCK ~~~~~

**Operating Systems (CSL 1502)**

**End –Semester Assignment, Odd 2021**

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4. Let the page fault service time be 10 ms. The average memory access time is 20 ns. If one page fault is generated per  $10^6$  instruction, then what is the effective memory access time? [4]
5. Why is rotational latency usually not considered in disk scheduling? [4]
6. In a disk system, the average seek time of is ns and the rotation rate is 3600 rpm. Each track has 512 sectors, each of size 2 kB. [5+5]
  - i. What is approximate time to read 1200 random sectors?
  - ii. What is data transfer rate?



## Operating Systems (CSL 1502)

### Mid –Semester Assignment, Odd 2021

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1. Discuss the relationship between operating systems and computer hardware? [3]
2. What is a process scheduler? State the characteristics of a good process scheduler? [4]
3. Define Peterson's solution to the critical section problem and also discuss its advantages and disadvantages. [8]
4. Shown below is the workload for 5 jobs arriving at time zero in the order given below:

| Job | Burst Time |
|-----|------------|
| 1   | 10         |
| 2   | 26         |
| 3   | 3          |
| 4   | 7          |
| 5   | 12         |

Now find out which algorithm among FCFS, SJF and Round Robin with quantum 3, would give the minimum average time. [10]

5. Consider 'n' processes sharing the CPU in round robin fashion. If the context switching time is 's' units, what must be the time quantum 'q' such that the number of context switches are reduced, but at the same time each process is guaranteed to get its turn at the CPU for every 't' units of time. [Hint: Obtain a relationship between q and t in terms of n] [5]