

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
END SEMESTER EXAMINATION- MAY 2023

Subject Code/ Name: CSPC43/ Operating Systems

Date: 10/ 05/ 2023

Marks: 50

Time : 9:30 pm – 12:30 pm

Answer all the Questions

1

- (a) Write briefly about the characteristics of the Mobile Operating Systems. (2)
- (b) For the following set of processes, with the help of Gantt charts calculate the average waiting and turnaround time, using SRTF scheduling algorithm. The arrival time and the burst are given in milliseconds (4)

Process ids	Arrival	Burst
P1	0	25
P2	10	12
P3	15	7
P4	25	10
P5	20	12

- (c) For the following code how many unique threads and processes are created? How? (3)

```
pid_t pid;
pid = fork();
if (pid == 0)
{
    fork();
    pthread_create(...);
}
fork();
```

- (d) What is dual mode operation? (1)

2.

- (a) In a recent NASA discovery, a planet is found to have three-handed philosophers. Consider a table with five three-handed philosophers and a pile of N chopsticks in the middle of the table. Each philosopher needs 3 chopsticks to eat. What is the smallest N such that deadlock is impossible? Explain (2)
- (b) Consider the following state of the system. Assume that P3 requests 3 instances of A, 4 instances of B and 2 instances of C. Can it be allocated the resources immediately? Why or why not? (3)

Process	Allocation	Max	Available
	A B C	A B C	
P0	1 4 1	5 6 2	A B C 2 0 0
P1	0 1 0	2 1 0	
P2	1 1 1	5 6 1	
P3	3 2 3	9 9 6	
P4	2 1 1	3 2 1	

- (c) Suppose you have a multi-process application in which each process requires some number of pages of memory. List the information needed in order to run the Banker's Algorithm. (3)
- (d) Show how the Peterson's algorithm satisfies the bounded waiting requirement. (2)

3.

- a. Consider a simple paging system with the following parameters: 2^{32} bytes of physical memory; page size of 2^{10} bytes; 2^{32} pages of logical address space. Explain (3)
- How many bits are in the logical address?
 - How many bits in the physical address specify the frame?
 - How many entries in the page table?
- b. Consider the following system implementing **Paging**. A process can be executed only if all of its pages are brought into the memory. Find the AWT and ATT of the system with the following tasks. Assume that the available memory for the processes is 1000 KB, and the page size is 200KB. Draw snapshots of memory at various times. (4)
- | Process-id | Arrival | Burst | Size(KB) |
|------------|---------|-------|----------|
| J1 | 0 | 20 | 500 |
| J2 | 0 | 30 | 300 |
| J3 | 10 | 20 | 400 |
| J4 | 20 | 10 | 700 |
- c. When do we need to page the page table? (1)
- d. Consider a swapping system in which memory consists of the following hole sizes in memory order: 10 MB, 4 MB, 20 MB, 18 MB, 7 MB, 9 MB, 12 MB, and 15 MB. Which hole is taken for successive segment requests of (a) 12 MB (b) 10 MB (c) 9 MB for worst fit? Illustrate. (2)

4.

- (a) Suppose that a machine has 48-bit virtual addresses and 32-bit physical addresses.
- If pages are 4 KB, how many entries are in the page table if it has only a single-level? Explain. (1)
 - Suppose this same system has a TLB (Translation Lookaside Buffer) with 32 entries. If 80 percent of all page-table references are found in the TLB, what is the effective memory reference time? (Assume that finding a page-table entry in the TLB takes 2 nanoseconds, if the entry is present.) *Time to access memory = 100 ns* (2)
- (b) Find the number of page-faults for the following page reference string using the LRU page replacement algorithm. Assume that four frames are available in the memory. (3)
- 1,0,2,2,1,7,6,7,0,1,2,0,3,0,4,5,1,5,2,4,5
- (c) Explain the difference between internal fragmentation and external fragmentation. Which one occurs in paging systems? Which one occurs in systems using pure segmentation? (2)
- (d) Compare the pros and cons of having a smaller and a larger page size. (2)

5.

- a. What is the need of an open -file table? (2)
- b. Suppose that a disk drive has 5,000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is:
- 86,1470,913,1774,948,1509,1022,1750,130
- Starting from the current head position, show and calculate the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for the SCAN disk scheduling algorithm. (3)
- c. Distinguish between rotational latency and seek time. (2)
- d. Explain Buddy systems. (3)