

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- May-2023

COURSE CODE(CREDITS-3): 18B11CI411

MAX. MARKS: 35

COURSE NAME: Operating System

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MAX. TIME: 2 Hour

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

Q1(a) What are the three main purposes of an operating system? [CO1] (03 Marks)

Q1(b) How many processes are generated by the following program code? Draw a tree showing the generation of parent-child processes. What is the output produced? [CO2] (05 Marks)

```
int main()
{
    if (fork() && (!fork())) {
        if (fork() || fork()) {
            fork();
        }
    }
    printf("2\n");
    return 0;
}
```

Q2(a) A CPU scheduling algorithm determines an order for the execution of its scheduled processes. Given 'n' processes to be scheduled on one processor, how many possible different schedules are there? [CO3] (02 Marks)

Q2(b) Consider the methods used by processes P1 and P2 for accessing their critical sections whenever needed, as given below. The initial values of shared boolean variables S1 and S2 are randomly assigned.

Method Used by P1	Method Used by P2
while (S1 == S2); Critical Section S1 = S2;	while (S1 != S2); Critical Section S2 = not (S1);

Describe whether the following properties are present/absent in the above code.

CO4{1x2=2}

- (a) Mutual Exclusion
- (b) Progress

Q3 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

There are 3 units of type X, 2 units of type Y and 2 units of type Z still available. The system is currently in safe state. Consider the following independent requests for additional resources in the current state-

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 above two requests can be permitted? Justify.

CO5 [04 Marks]

Q4(a) A computer has 1000 K of main memory. The jobs arrive and finish in the following sequence:

Job 1 requiring 200 K arrives

Job 2 requiring 350 K arrives

Job 3 requiring 300 K arrives

Job 1 finishes

Job 4 requiring 120 K arrives

Job 5 requiring 150 K arrives

Job 6 requiring 80 K arrives

Compare the performance of first-fit and best-fit strategy for the given scenario.

[CO6] (03 Marks)

Q4(b) Consider a logical address space of 256 pages with a 4-KB page size, mapped onto a physical memory of 64 frames.

[CO6] (2x2= 04 Marks)

a. How many bits are required in the logical address?

b. How many bits are required in the physical address?

Q5(a) A process generates the following sequence of memory references when its instructions are executed.

[CO6] (2x2 = 04 Marks)

0100, 0432, 0101, 0612, 0102, 0103, 0104, 0101, 0611, 0102, 0103,
0104, 0101, 0610, 0102, 0103, 0104, 0101, 0609, 0102, 0105

Assuming page size as 100 bytes, answer the following questions.

(a) Generate a reference string for page replacement from the above given memory references.

(b) Compute the number of page faults for FIFO Page Replacement Algorithm.

Q5(b) Consider a demand paging system with four-page frames (initially empty) and LRU page replacement policy.

For the following page reference string

[CO6] (04 Marks)

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

Compute the page fault rate. The page fault rate is defined as the ratio of number of page faults to the number of memory accesses.

Q6 Disk requests come to disk driver for cylinders 10,22,20,2,40,6 and 38, in that order at a time when the disk drive is reading from cylinder 20. The seek time is 6 milliseconds per cylinder. Compute the total seek time if the disk arm scheduling algorithm is

[CO6] (2x2 = 04 Marks)

- A. First Come First Served (FCFS).
- B. Shortest Seek Time First (SSTF).