JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS-2022

B.Tech-III Semester (CSE&IT)

COURSE CODE (CREDITS): 18B11CI411 MAX. MARKS: 35

COURSE NAME: Operating Systems

COURSE INSTRUCTORS: Dr. Pradeep Kumar Gupta, Dr. Hari Singh, Dr. Deepak Gupta, Mr. Prateek and Mr. Surjeet MAX. TIME: 2 Hours

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

Q1. The services and functions provided by an operating system can be divided into two main categories. Briefly describe the two categories and discuss how they differ.

(CO1) [3Marks]

Q2. Draw tree structure of the following program code. What is the output? **(CO2)[3+1 Marks]**

```
int main()
{
    if(fork() && (!fork()) || fork()) {
        if(fork() && fork()) {
            fork();
            }
    }
printf("1\n");
return 0;
}
```

Q3. Using Amdahl's Law, calculate the speedup gain of an application that has a 60 percent parallel component for two processing cores **(CO3)[2 Marks]**

Q4. The following program consists of 3 concurrent processes and 3 binary semaphores. The semaphores are initialized as S0=1, S1=0, S2=0. How many times will process P0 print '0'? Write all the steps in detail. **[CO4][3 Marks]**

Process P0	Process P1	Process P2

while (true) {
wait (S0);
print (0);
release (S1);
release (S2);
}
	wait (S1);
	Release (S0);
		wait (S2);
		Release (S0);

Q5. Two shared resources R_1 and R_2 are used by processes P_1 and P_2. Each process has a certain priority for accessing each resource. Let T_{ij} denote the priority of P_i for accessing R_j. A process P_i can snatch a resource R_k from process P_j if T_{ik} is greater than T_{jk}. Given the following:

1. $T_{11} > T_{21}$
2. $T_{12} > T_{22}$
3. $T_{11} < T_{21}$
4. $T_{12} < T_{22}$

Describe condition(s)which ensures that P_1 and P_2 can never deadlock? **(CO5)[3 Marks]**

Q6. A system contains three programs and each requires three tape units for its operation. What is minimum number of tape units which the system must have such that deadlocks never arise? **(CO5)[3 Marks]**

Q7. Consider a three level paging scheme with a TLB. Assume no page fault occurs. It takes 20 ns to search the TLB and 100 ns to access the physical memory. If TLB hit ratio is 80%, then calculate the effective memory access time? **(CO5)[3 Marks]**

Q8. Consider a computer system with a 32-bit logical address and 4-KB page size. The system supports up to 512 MB of physical memory. How many entries are there in each of the following? **(CO5)[2+2 Marks]**

a. A conventional, single-level page table
b. An inverted page table

Q9. When a page fault occurs, it causes a sequence of events/steps, describe. Draw a diagram explaining these steps to handle a page fault. **(CO6)[2+1 Marks]**

Q10. Consider the following page reference string: **(CO6) [2 + 2 Marks]**

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 three frames? Remember that all frames are initially empty, so your first unique pages will cost one fault each

(a) LRU replacement
(b) FIFO replacement

Q11. Consider a storage disk with 4 platters (numbered as 0, 1, 2 and 3), 200 cylinders (numbered as 0, 1, ..., 199), and 256 sectors per track (numbered as 0, 1, ... , 255). The following 6 disk requests of the form [sector number, cylinder number, platter number] are received by the disk controller at the same time:

[120, 72, 2], [180, 134, 1], [60, 20, 0], [212, 86, 3], [56, 116, 2], [118, 16, 1]

Currently the head is positioned at sector number 100 of cylinder 80, and is moving towards higher cylinder numbers. The average power dissipation in moving the head over 100 cylinders is 20 milliwatts and for reversing the direction of the head movement once is 15 milliwatts. Powerdissipation associated with rotational latency and switching of head between different platters is negligible. Calculate total power consumption in milliwatts to satisfy all of the above disk requests using the Shortest Seek Time First (SSTF) disk scheduling algorithm. **(CO6)[3 Marks]**