

**Comprehensive Exam**

Course No. : CS F372  
Course Title : Operating Systems  
Nature of Exam : Open Book  
Weightage : 60 Marks  
Duration : 120 Minutes from 03.00 PM to 05.00 PM.  
Date of Exam : 08-01-2021

No. of Pages	= 2
No. of Questions	= 6

Note:

1. Please follow all the *Instructions to Candidates* given on the cover page of the answer book.
2. All parts of a question should be answered consecutively. Each answer should start from a fresh page.
3. Assumptions made if any, should be stated clearly at the beginning of your answer.
4. Total marks after evaluation would be scaled to 135.

1. a) How many times will hello be printed on the console on executing the code snippet shown below? [3M]

```
pid_t p;  
fork();  
fork();  
p = fork();  
if(p == 0)  
    fork();  
if(p > 0){  
    fork();  
    fork();  
    fork();  
}  
printf("\nhello\n");
```

- b) What could be the output of the following code snippet? [3M]

```
int main()  
{  
    pid_t pid, pid1, pid2;  
    pid = fork();  
    pid1 = getpid();  
    pid2 = getpid();  
    if(pid1 == pid2)  
        printf("\nGood\n");  
    else  
        printf("\nBad\n");  
    return 0;  
}
```

- c) What are the various kinds of performance overhead associated with serving an interrupt.?. [4M]

2. a) Consider three processes (process id 0, 1, 2 respectively) with compute time bursts 4, 8 and 12 time units. All processes arrive at time 0. What is the average turnaround time for these processes if they are scheduled for processing using the Longest Remaining Time First (LRTF) algorithm?  
[5M]
- b) How could a system be designed to allow a choice of operating systems from which to boot? What would the bootstrap program need to do?  
[5M]
3. What resources are used when a thread is created? How do they differ from those used when a process is created?. Also, explain under what circumstances does a multithreaded solution using multiple kernel threads provide better performance than a single-threaded solution on a single-processor system?  
[5M]
5. What are two models of interprocess communication? What are the strengths and weaknesses of the two approaches?  
[5M]
6. A computer system contains three types of resources - R1, R2 and R3. A total of 12 instances of R1, 6 instances of R2 and 12 instances of R3 are present in the system. Currently, four processes, P1, P2, P3 and P4 are active in the system. The current snapshot of the system is shown in the below image. Determine a safe sequence (if one exists) for the given system state using Banker's algorithm. Clearly show all the steps by calculating the Need data structure and the Available data structure at each step, the conditions that are satisfied and the sequence in which resource requests of processes can be satisfied.  
[10M]

Process	Allocation			Max			Available		
	R1	R2	R3	R1	R2	R3	R1	R2	R3
P1	2	2	0	3	2	3	2	1	3
P2	3	1	4	6	4	8			
P3	1	2	3	2	5	3			
P4	4	0	2	7	6	5			

7. Consider the following sequence of references to the given page numbers - 2, 1, 3, 4, 3, 4, 4, 5, 1, 2, 2, 1, 4, 3, 4, 3, 2, 1, 4, 2, 3. If Optimal page replacement algorithm is used, determine the number of page faults with 3 physical frames. Assume that the system uses pure demand paging. If as per the strategy, more than one page is eligible for replacement, replace the page with the lower value of page number. Show in detail how the page faults occur and how the pages are replaced.  
[8M]
8. Why do some systems keep track of the type of a file, while others leave it to the user and others simply do not implement multiple file types?. Which system is better? and why.? [6M]
9. Suppose that a disk drive has 5000 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, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests using FCFS and C-SCAN disk scheduling algorithms.  
[6M]

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