MANIPAL UNIVERSITY JAIPUR

School of Computing & IT

IV Semester B. Tech End Semester Examination **May-2017**

CS 1401 Operating Systems Branch: CSE / IT /CCE

QUESTION PAPER

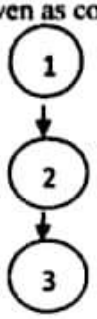
Duration: 3hrs **[OPEN BOOK]** **Max Marks: 80**

Notes: 1. Answer any **FIVE** full questions. Numbers in [ ] indicates marks.
2. Missing data, if any, may be suitably assumed. Course instructor shall not be called.
3. At most three units of bounded references are allowed.

Q1. a. Write a program in C using *PThreads* for copying the contents of three files named *A.txt, B.txt* and *C.txt* into files *f1, f2* and *f3* respectively. (Use separate thread for copying the contents of each file and file copying should be in parallel). **[6]**

b. Write a program in C using pipe in which first process passes integer value to the second process which displays the square of it on the screen. **[6]**

c Write a program in C (Linux OS) that creates a chain of *n* processes as shown in figure below (when called with a command-line argument of 3), where *n* is given as command-line argument. **[4]**



Q2. a. Given reference to the pages by a program as 1, 2, 3, 2, 3, 5, 4, 2, 1, 3, 2, 4, 1 **[6]**
How many page faults will occur in LRU, FIFO and OPTIMAL page replacement policies, if the program has three page frames available to it?

b. The memory access time is 1 nanosecond for a read operation with a hit in cache, 5 nanoseconds for a read operation with a miss in cache, 2 nanoseconds for a write operation with a hit in cache and 10 nanoseconds for a write operation with a miss in cache. Execution of a sequence of instructions involves 100 instruction **fetch** operations, 60 memory operand **read** operations and 40 memory operand **write** operations. The cache hit-ratio is 0.9. Calculate the average memory access time in executing the sequence of instructions. **[6]**

c A system that uses a two-level page table has 32 bit virtual addresses. The first 9 bits of the address serve as the index into the first level page table and the next 12 bits specify the level two page table entry. **[4]**

i. How many entries will be there in a level two page table?

ii. How many bytes in a page?

Q3. a. Consider a file system that uses index allocation. Disk blocks are 4 KB in size and a pointer to a disk block requires 4 bytes. Index allocation uses one single, one double and one triple indirect disk blocks. What is the maximum size of a file that can be stored on disk using this file system? **[6]**

b. Suppose the following disk request sequence (track numbers) for a disk with 100 tracks is given: 45, 20, 90, 10, 50, 60, 80, 25, and 70. Assume that the initial position of the R/W head is on track 50 from previous position 23. Calculate the total Seek time for FCFS, SSTF, SCAN, LOOK and C-LOOK disk scheduling algorithms. **[10]**

Q4. a. On a system using paging and segmentation, the virtual address space consists of up to 16 segments where each segment can be up to 2^{28} bytes long. The hardware pages each segment into 512 bytes pages. How many bits in the virtual address specify the segment number, page number, offset within the page and entire virtual address? **[4]**

b. Consider a machine with 256 MB physical memory and a 32 bit virtual address space. If the page size is 4 KB, what is the approximate size of the page table? **[4]**

Q4. Consider the following snapshot of a system with five process (P1, P2, P3, P4, P5) and four resources (R1, R2, R3, R4). There is no current outstanding queued unsatisfied request. [8]

	Allocation				Maximum				Available			
Process	R1	R2	R3	R4	R1	R2	R3	R4	R1	R2	R3	R4
P1	0	0	1	2	0	0	3	2	2	1	2	0
P2	2	0	0	0	2	7	5	0				
P3	0	0	3	4	6	6	5	6				
P4	2	3	5	4	4	3	5	6				
P5	0	3	3	2	0	6	5	2				

i. What will be the need of each process?
ii. Is the system in safe state? If yes, specify the process execution sequence?
iii. If a request from a process P1 arrives for (0, 4, 2, 0), can the request be granted immediately?
iv. If a request from a process P2 arrives for (0, 1, 2, 0), can the request be granted immediately?

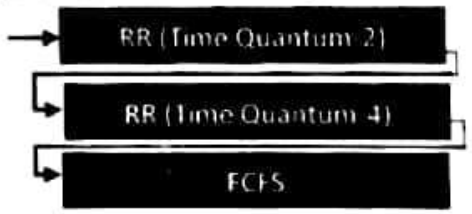
Q5. a. Write a solution using semaphores to synchronize processes A, B, C, and D so that A completes before any other process (B, C, or D) starts, and process B completes before process C or process D may execute, but process C and process D may execute concurrently. [8]

b. Does the following solution satisfy entire three requirements of critical section problem? Justify your answer. [8]

```
int i=0; int j=1-i;
flag[0] = flag[1] = 0;
while(true)
{     while (flag[j]);
      flag[i] =1;
      /* critical section */
      flag[i]:=0;
      /* remainder section */ }
```

Q6. a. Consider the following set of processes, with the length of the CPU-burst time given in milliseconds [8]

Process	Arrival Time	Burst Time
P1	0	14
P2	0	9
P3	3	7
P4	8	8



Draw Gantt charts illustrating the execution of these processes using Multi-level feedback Queue and SJF CPU scheduling algorithm and also calculate the average turnaround time and average waiting time.

b. Consider a file currently consisting of 200 blocks. Assume that the file control block is already in memory. Calculate how many disk I/O operations are required for contiguous and linked allocation strategies, if, for one block, the following conditions hold. In the contiguous- allocation case, assume that there is no room to grow in the beginning, but there is room to grow in the end. Assume that the block information to be added is stored in memory. Write down the required number of read and write disk I/O operations separately in each case. [8]

a. The block is added at the beginning.
b. The block is added in the middle.
c. The block is added at the end.
d. The block is removed from the beginning.
e. The block is removed from the middle.
f. The block is removed from the end.

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