Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY, MANIPAL 576104

(Constituent College of Manipal University)

FIFTH SEMESTER B. Tech(IT) DEGREE END SEMESTER EXAMINATION, DEC– 2015

SUBJECT: OPERATING SYSTEMS – ICT 301

(REVISED CREDIT SYSTEM)

TIME: 3 HOURS **4/12/2015** **MAX. MARKS: 50**

Instructions to candidates

- Answer any **FIVE FULL** questions.
- Missing data, if any, may be suitably assumed.

1A. Write the first three versions of Dekker's algorithm and their drawbacks. Write and explain the correct version of Dekker's algorithm and explain how the correct version of Dekker's algorithm overcomes the drawbacks of first three versions.

1B. What are the two fundamental models of inter-process communication? Explain.

1C. Write a note on the following threading issues.

(i) Thread cancellation (ii) Signal handling [5+3+2]

2A. Consider four CPU-intensive processes (P1, P2, P3, P4), which require 10, 20, 26 and 14 time units, and arrive at times 0, 2, 6 and 15 respectively.

(i) Draw a Gantt Chart and determine the number of context switches needed if the operating system implements a shortest remaining time first scheduling algorithm. Do not count the context switches at time zero and at the end.

(ii) Draw a Gantt Chart and determine the waiting time of individual processes and the average waiting time if the operating system implements a Round Robin algorithm with time slice=5 units.

(iii) Draw a Gantt Chart and determine the turnaround time of individual processes and the average turnaround time if the operating system implements a non-preemptive Priority algorithm. The priority values are 2, 4 ,1 and 3 for the processes P1, P2, P3 and P4 respectively. Assume lowest value has the highest priority.

2B. Explain the three common ways of mapping user threads to kernel threads with neat diagrams.

2C. List and define the four components of Linux virtual file system. [5+3+2]

3A. Consider a system with processes P0 through P4 and four resource types A, B, C, D. Assume resource type A has 20 instances, resource type B has 4 instances and resource type C has 6 instances, resource type D has 9 instances. Following is the Maximum and Allocation matrices:

Process	Allocation				Max			
	A	**B**	**C**	**D**	**A**	**B**	**C**	**D**
P0	5	0	1	3	15	1	2	4
P1	3	0	2	0	5	4	3	9
P2	2	0	1	1	2	2	2	9
P3	6	1	1	0	8	1	1	0
P4	0	3	1	2	5	3	3	6

(i) Draw the resource allocation graph for the above scenario.

(ii) Find the available vector and need matrix.

(iii) Check whether the system remains in safe state or not. If system is in safe state then give the safe sequence otherwise write the processes involved in the deadlock.

(iv) For the following independent requests from P4 and P1, check if the system is in safe state or not. If system is in safe state, give the safe sequence otherwise write the processes involved in the deadlock. Process P4 requests (2, 0, 0, 2) and the process P1 requests (3, 0, 0, 1)

3B. Assume we have a demand-paged memory. The page table is held in registers. It takes 8 milliseconds to service a page fault if an empty page is available or the replaced page is not modified and 20 milliseconds if the replaced page is modified. Memory access time is 100 nanoseconds. Assume that the page to be replaced is modified 70% of the time. What is the maximum acceptable page-fault rate for an effective access time of no more than 200 nanoseconds?

3C. Each process Pi, i = 0,1,2,3,……,9 is coded as given below. The code for P10 is identical except that it uses V(mutex) instead of P(mutex). What is the largest number of processes that can be inside the critical section at any moment (the mutex being initialized to 1)? Explain.

```
repeat
    P(mutex)
      {Critical Section}
    V(mutex)
forever
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[5+3+2]

4A. What is segmentation? Explain the segmentation architecture/hardware with a neat diagram. Give an example for mapping logical address to physical address. What is the need to combine paging with segmentation?

4B. Consider a system with 5 processes P1, P2, P3, P4 and P5 with single instances of resources R1, R2, R3, R4, R5 and R6. P1 has R1 and R6. P2 has R2 and requests for R6. P3 has R4 and request for R3 and R5. P4 has R5 and request for R4 and R6. P5 has R3 and requests for R2 and R5. Draw the resource allocation graph for the above and check for the presence of a cycle. Is the system in a safe state? If yes, write the safe sequence. If system is deadlocked write the processes involved in deadlock.

4C. Differentiate between Batch Operating System and Time Sharing Operating System? [5+3+2]

5A. Describe the uses of logical organization of a directory structure. Explain any four types of directory organization.

5B. In a computer system while allocating 'jobs' to 'memory partitions', the following situation was encountered: Partitions sizes in KB : 4, 8, 20, 2, 10; Jobs sizes in KB: 2, 4, 3, 6,20, 4; Time for execution 4, 10, 2, 1, 4, 6; How would the first-fit, best-fit, and worst-fit algorithms place processes in partitions? Which algorithm makes the most efficient use of memory? When will the 20K job completes for best-fit, first-fit and worst-fit algorithms?

5C. In a paged memory, the page hit ratio is 0.35. The time required to access a page in secondary memory is 100 ns. The time required to access a page in primary memory is 10 ns. Find the average time required to access a page. [5+3+2]

6A. Consider the following page reference string for a program: 5,4,3,2,1,4,3,5,4,3,2,1,5

(i) Show how pages will be allocated using the FIFO page replacement policy. Also calculate the total number of page faults by considering the frame size as 3 and 4 respectively.

(ii) Show how pages will be allocated using the second chance (clock) page replacement algorithm and determine the number of page hits by assuming the frame size as 3 and 4 respectively.

(iii) Show how pages will be allocated using the optimal page replacement algorithm and determine the number of page faults by assuming the frame size as 3.

6B. Explain the following page replacement algorithms:

(i) Additional Reference Bits (Byte) algorithm (ii) Enhanced Second Chance Algorithm

6C. Consider the situation in which the disk read/write head is currently located at track 45 (of tracks 0-255) and moving in the positive direction. Assume that the following track requests have been made in this order: 40, 67, 11, 240, 87. What is the order in which C-SCAN and LOOK would service these requests and what is the total seek distance? Give pictorial representation of the head movement starting from the current head position. [5+3+2]