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# MANIPAL INSTITUTE OF TECHNOLOGY

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**V SEMESTER B.TECH. (INFORMATION TECHNOLOGY)**
**MAKE UP EXAMINATIONS, DEC 2018**
SUBJECT: OPERATING SYSTEMS [ICT 3101]
**REVISED CREDIT SYSTEM**
**(30 /12/2018)**

Time: 3 Hours MAX. MARKS: 50

**Instructions to Candidates:**
- Answer **ALL** the questions.
- Missing data, if any, may be suitably assumed.

**1A.** Explain any five services provided by the operating system that creates convenience to the users. **5**

**1B.** The queue of pending requests, in FIFO order is given as 130, 1750, 1022, 1509, 948, 1774, 913, 1470. Starting from the current head position 86, what is total distance (in Cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk scheduling algorithms:
(i) SCAN
(ii) C-LOOK
(iii) SSTF **3**

**1C.** Draw the resource allocation graph and explain whether deadlock exists or not for the following situation. There are four processes {P1,P2, P3, P4} and 3 resources consist of one instance of resource type R1, one instance of resource type R2, three instances of resource type R3.
**Process States:**
P1 is waiting an instance of resource type R1 and is holding an instance of resource type R2 and an instance of resource type R3.
P2 is holding an instance of resource type R3
P3 is holding an instance of resource type R3
P4 is waiting an instance of resource type R2 & is holding an instance of resource type R1. **2**

**2A.** Explain the significance of second chance page replacement technique. Consider the reference string 1,4,5,2,6,3,2,5,3,4,7,1,5,1,6 and the frame size as 3. Show the page allocation and calculate the number of page faults using optimal, LRU and FIFO replacement techniques. **5**

**2B.** With a neat diagram illustrate various methods of allocating disk space. **3**

**2C.** Considering the program below, identify the values of pid at lines A, B,C, and D. Assume that the actual pids of the parent and child are 2600 and 2603, respectively.

```
#include <sys/types.h>
#include <stdio.h>
#include <unistd.h>
int main ()
{
 /* fork a child process */
```

**2**

```
pid = fork();
if ( pid < 0 ) { /*error occurred
fprintf(stderr, "Fork Failed");
return 1;
}
else if (pid ==0) { /* child process */
pid1 = getpid();
printf("child: pid = %d" ,pid); /* A */
printf("child: pid1 = %d" ,pid1); /* B */
}
else { /* parent process */
pid1 = getpid();
printf("parent: pid = %d" ,pid); /* C */
printf("parent: pid1 = %d" ,pid1); /* D */
wait(NULL);
}
return 0;
}
```

**3A.** Consider the following set of processes, with the length of the CPU-burst time given in milliseconds. Assume low priority number represents high priority.

| Process | Burst time | Arrival time | Priority Number |
|---|---|---|---|
| P1 | 5 | 0 | 3 |
| P2 | 4 | 1 | 1 |
| P3 | 2 | 3 | 4 |
| P4 | 6 | 4 | 2 |
| P5 | 3 | 7 | 5 |

Write Gantt Chart and obtain average waiting time and average turnaround time of the processes by applying

i. Round robin algorithm considering time slice as 2 seconds
ii. Non-preemptive shortest job first algorithm
iii. Priority preemptive scheduling algorithm

**5**

**3B.** Consider following snapshot of the system in Table Q.3B. There are 3 instances of resource A, 9 instances of resource B and 11 instances of type C in the system. Check if the system is in a safe state? Write the sequence if safe. If P3 requests for (0, 6, 0), can the request be granted immediately?

Table Q. 3B

| Process | Allocation | | | Max Need | | |
|---|---|---|---|---|---|---|
| | A | B | C | A | B | C |
| P0 | 0 | 0 | 1 | 0 | 0 | 1 |
| P1 | 0 | 7 | 6 | 0 | 1 | 3 |
| P2 | 2 | 3 | 5 | 1 | 3 | 5 |
| P3 | 1 | 9 | 5 | 1 | 0 | 0 |

**3**

**3C.** Given five memory partitions of 100 KB, 500 KB, 200 KB, 300 KB, and 600K, how would the first-fit and best-fit, algorithms place processes of 212 KB, 417 KB, 112 KB, and 426 KB?

**2**

4A. Differentiate between logical address and physical address. Explain with a hardware block diagram how the logical address is mapped to physical address in the Paging memory management. 5

4B. Three concurrent processes X, Y, and Z execute three different code segments that access and update certain shared variables. Process X executes the P operation (i.e., wait) on semaphores a, b and c; process Y executes the P operation on semaphores b, c and d; process Z executes the P operation on semaphores c, d, and a before entering the respective code segments. After completing the execution of its code segment, each process invokes the V operation (i.e., signal) on its three semaphores. All semaphores are binary semaphores initialized to one. Write the deadlock free order of invoking the P operations by the process. Justify your answer. 3

4C. List down the sequence of steps followed in order to service a page fault in virtual memory. 2

5A. What are the factors that need to be considered to determine the degree of multiprogramming in a system? Discuss any four challenges in programming for multicore systems. 5

5B. What is the purpose of paging the page tables? If the hit ratio to a TLB is 80%, and it takes 20 nanoseconds to search the TLB, and 100 nanoseconds to access the main memory, then what is the effective memory access time in nanoseconds? 3

5C. Discuss the various hardware solutions to mutual exclusion problem. 2