Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL
(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH. (INFORMATION TECHNOLOGY)

END SEMESTER EXAMINATIONS, NOV 2019

SUBJECT: OPERATING SYSTEM [ICT 3101]

REVISED CREDIT SYSTEM

(25/11/2019)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. Consider 5 processes which are in various process states. Assume that at time 5 no system resources are being used except for the processor and memory. Now consider the following events:

Time : Event
05 : P1 executes a command to read from disk unit 3
15 : P5's time slice expires
18 : P3 executes a command to read from disk unit 2
20 : P7 executes a command to write to disk unit 3
24 : P5 executes a command to write to disk unit 3
28 : P5 is swapped out
33 : An interrupt occurs from disk unit 3: P1's read is complete
36 : An interrupt occurs from disk unit 2: P3's read is complete
38 : P8 terminates
40 : An interrupt occurs from disk unit 3: P5's write is complete
44 : P5 is swapped back in
48 : An interrupt occurs from disk unit 3: P7's write is complete

For each time 22, 37, and 47, identify which state each process is in. If a process is blocked, further identify the event on which is it blocked. **5**

1B. What are the advantages of multiprocessor system as against the single processor system? Specify the various types of multiprocessor system along with their features. **3**

1C. Analyse and show how many times the printf statement is executed?

```
#include <stdio.h>
#include <unistd.h>
int main()
{
   fork();
   fork() && fork() || fork();
   fork();
   printf("forked\n");
   return 0;
}
```

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2A. Explain the various threading issues that are encountered with multithreaded programs. **5**

2B. A uni-processor computer system only has two processes, both of which alternate 10 ms CPU bursts with 90 ms I/O bursts. Both the processes were created at nearly the same time. The I/O of both processes can proceed in parallel. Which of the following scheduling strategies will result in the least CPU utilization (over a long period of time) for this system?

i. First come first served scheduling.

ii. Shortest remaining time first scheduling.

iii. Priority scheduling with priorities 1 and 2 for the two processes where 1 signifies higher priority.

iv. Round robin scheduling with a time quantum of 5 ms **3**

2C. Consider two process with burst time 20 and 40 utilising three level feedback queue. The first and second level uses round robin and the last level uses FCFS. The time quantum for first level is 2 and 4 for the second level. Find the average waiting time and average turnaround time and check this if only round robin was used? What parameters define the multilevel feedback queue scheduler algorithms ? **2**

3A. Consider a system with 20 bit logical address and 32 bit physical address. There are 7 free frames to be shared between two processes of size 10K and 20K using proportional allocation of frames. Each process access the reference string 1, 2, 5, 2, 3, 1, 4, 8, 5, 9, 1, 2, 8, 9, 7, 3, 9, 2. Calculate the number of page faults for LRU and Optimal page replacements for process P1 and P2. **5**

3B. A shared variable x, initialized to zero, is operated on by four concurrent processes W, X, Y, Z as follows. Each of the processes W and X reads x from memory, increments by one, stores it to memory, and then terminates. Each of the processes Y and Z reads x from memory, decrements by two, stores it to memory, and then terminates. Each process before reading x invokes the P operation (i.e., wait) on a counting semaphore S and invokes the V operation (i.e., signal) on the semaphore S after storing x to memory. Semaphore S is initialized to two. What is the maximum possible value of x after all processes complete execution? **3**

3C. What conditions should be satisfied to overcome the critical- section problem? Analyze how is this achieved using Perterson's solution. **2**

4A. Consider the following sequence of disk track requests: 64, 186, 133, 27, 129, 110, 147, 41, 10. Assume that the disk head is initially positioned over track 100 and is moving in the direction of increasing track number. The highest track number available is 999. Calculate the total seek time of the R/W head using the SSTF, SCAN, C-SCAN, C-LOOK and FIFO disk scheduling algorithms. **5**

4B. In a 32-bit machine the virtual address is subdivided into 4 segments as follows:

10-bit	8-bit	6-bit	8 bit

It uses a 3-level page table, such that the first 10-bit are for the first level and so on.

i. What is the page size in such a system?

ii. What is the size of a page table for a process that has 256K of memory starting at address 0 and having single level page table with each entry of 4 bytes?

iii. What is the size of page table for a process that has 512K of memory and using three level page table with each entry of 4 bytes? **3**

4C. How does choice of block size affect file system performance. Explain considering both sequential and random access. **2**

5A. Consider the following ways of handling deadlock:

(A) banker's algorithm,
(B) detect deadlock and kill thread, releasing all resources,
(C) reserve all resources in advance,
(D) restart thread and release all resources if thread needs to wait,
(E) resource ordering, and
(F) detect deadlock and roll back thread's actions.

i. One criterion to use in evaluating different approaches to deadlock is which approach permits the greatest concurrency. In other words, which approach allows the most threads to make progress without waiting when there is no deadlock. Give a rank order from 1 to 6 for each of the ways of handling deadlock just listed, where 1 allows the greatest degree of concurrency. Comment on your ordering.

ii. Another criterion is efficiency; in other words, which requires the least processor overhead. Rank the order of approaches from 1 to 6, with 1 being the most efficient, assuming that deadlock is a very rare event. Comment on your ordering.

iii. Does your ordering from (ii) change if deadlocks occur frequently?

5

5B. A computer system has 1000KB of main memory. The jobs arrive and finish in the following sequence:

a. Job1 requiring 200KB arrives
b. Job2 requiring 350KB arrives
c. Job3 requiring 300KB arrives
d. Job1 finishes
e. Job4 requiring 120KB arrives
f. Job5 requiring 150KB arrives
g. Job6 requiring 80KB arrives

i. Draw the memory allocation using best fit and worst fit methods.

ii. Which algorithm performs better for this sequence? Justify.

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5C. A process repeatedly requests and releases resources of types R1 and R2, one at a time and in that order. There is exactly one instance of R1 and one instance of R2. A second process also requests and releases these resources one at a time repeatedly. Under what circumstances could these processes deadlock? If so, what could be done to prevent deadlock?

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