National Institute of Technology Kurukshetra
END SEMESTER EXAMINATION December 2022 (Reappear)
Question Paper
B.Tech. IV Semester (Computer Engineering)

Paper: **Operating Systems**
Maximum Marks: **50**
Number of Questions to be attempted: **6**

Course Code: **CSPC 20**
Time Allowed: **3 hours**
Total number of questions: **6**

1. (a) Interrupts are an important part of a computer architecture. How these are useful in the functioning of operating system.
(b) Show the design of data structure that stores the definition of PCB?
(c) Why can't you disallow mutual exclusion in order to prevent deadlocks?
(d) What is busy waiting? How to overcome this problem?
(e) What is vfork() system call available in certain operating systems? Explain why the vfork() system call is more efficient than fork().
(f) Assume that a thread has blocked for network I/O and is eligible to run again. Describe why a NUMA-aware scheduling algorithm should reschedule the thread on the same CPU on which it previously ran. **(1 x 6)**

2. (a) Consider two processes, P1 and P2, where p1 = 50, t1 = 25, p2 = 75, and t2 = 30. Can these two processes be scheduled using rate-monotonic scheduling? **(4)**
(b) Why is the performance of the context-switching mechanism critical to the performance of a highly multiprogrammed system? **(4)**

3. (a) Consider the parameter Δ used to define the working-set window in the working-set model. What is the effect of setting Δ to a small value on the page fault frequency and the number of active (non-suspended) processes currently executing in the system? What is the effect when Δ is set to a very high value? **(3)**
(b) Which of the following CPU scheduling algorithms could result in starvation and why?
(i) First-come, first-served
(ii) Shortest job first
(iii) Round robin
(iv) Priority **(4)**

4. (a) Consider a logical address space of 32 pages with 1024 words per page; mapped onto a physical memory of 16 frames.
(i) How many bits are required in the logical address?
(ii) How many bits are required in the physical address? **(4)**
(b) How to continue a prompted instruction in a paged memory
(i) If the page fault occurs on the instruction fetch
(ii) If a page fault occurs while we are fetching an operand **(2)**
(c) Consider a system that uses pure demand paging.
(i) When a process first starts execution, what will be behaviour of page-fault rate?

(ii) Once the working set for a process is loaded into memory, what will be behaviour of the page-fault rate? **(4)**

5. (a) Prove that the algorithm shown below satisfies all three requirements for the critical-section problem.

```
do {
   flag[i] = true;

   while (flag[j]) {
      if (turn == j) {
         flag[i] = false;
         while (turn == j)
            ; /* do nothing */
         flag[i] = true;
      }
   }

      /* critical section */

   turn = j;
   flag[i] = false;

      /* remainder section */
} while (true);
```

(6)

(b) Given six memory partitions of 100 MB, 170 MB, 40 MB, 205 MB, 300 MB, and 185 MB (in order), how would the first-fit, best-fit, and worst-fit algorithms place processes of size ~~200 MB~~, 15 MB, ~~185 MB~~, ~~75 MB~~, ~~175 MB~~, and ~~80 MB~~ (in order)? Indicate which—if any—requests cannot be satisfied. **(4)**

6. (a) Differentiate between SCAN and LOOK scheduling schemes. **(4)**
(b) Explain RAID0, RAID1, RAID10 and RAID01 along with necessary diagrams. **(5)**

THE END