INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY, SHIBPUR

Name of the Examination: 6th Semester Examinations, 2021

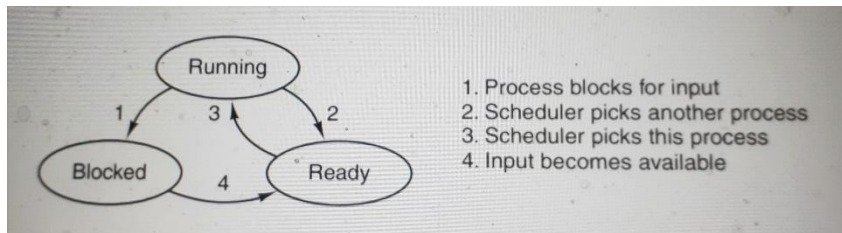 Name of the Subject: Operating System. Subject Code: CS 601

Date of Examination: 25-05-2021

Name of the Student _____

Examination Roll Number_____

G Suite ID_____ _____ Number of Sheets uploaded _____

- **All question carry equal marks.** Note that full marks is 70 and time is 90 minutes only. So, choose questions carefully and try to score as much as you can. Score more than 70 would be truncated to 70.
- Both machine-printed and hand-printed answer scripts will be accepted.
- For figures, if any, draw it (No copy from any source) and import on your answer script
- **YOUR SIGNATURE MUST BE IMPORTED or handprinted** at the end of the script

1. A 255-GB disk has 65,536 cylinders with 255 sectors per track and 512 bytes per sector. How many platters and heads does this disk have? Assuming an average cylinder seek time of 11 msec, average rotational delay of 7 msec and reading rate of 100 MB/sec, calculate the average time it will take to read 400 KB from one sector.

2. Which of the following instructions should be allowed only in kernel mode? (a) Disable all interrupts. (b) Read the time-of-day clock. (c) Set the time-of-day clock. (d) Change the memory map.

3. For each of the following system calls, give a condition that causes it to fail: fork, exec, and unlink.

4. What type of multiplexing (time, space, or both) can be used for sharing the following resources: CPU, memory, disk, network card, printer, keyboard, and display?

5. Modern operating systems decouple a process address space from the machine's physical memory. List two advantages of this design

6. The process transition diagram shown below has 4 transitions – out of possible 6 (2 out of each state). What are the transitions missing in the diagram and why?

Running

1 3 2

Blocked 4 Ready

1. Process blocks for input
2. Scheduler picks another process
3. Scheduler picks this process
4. Input becomes available

7. Even in modern OS interrupt handlers are written in assembly language; why?

8. A computer has 3 GB of total memory of which OS occupies 1536 MB. Let all the processes, each 256 MB, are identical in characteristics and 93% of CPU utilization is wanted. What is the maximum I/O wait (in %) that can be allowed?

9. What is the biggest advantage of implementing threads in user space? What is the biggest disadvantage?

10. Find out the average wait time using a combination of priority scheduling and Round Robin policy (for the processes with the same priority) shown in the following table with a time slice of 3 units.

Process	CPU Burst	priority
P1	4	3
P2	5	2
P3	8	2
P4	7	1
P5	3	3

11. If the maximum no. of processes is 'n' and the maximum number of bytes per process is 'v' in virtual address space then what would be the expression representing the maximum amount of disk storage requirements given the memory has a total of 'm' bits. Comment on the feasibility of a virtual memory system in any standard computer with the usual amount of RAM (couple of GB) and the storage (half to one TB).

12. (a) What is the main advantage of a multilevel page table over a single-level one?

(b) Suppose that a machine has 36-bit virtual addresses and 32-bit physical addresses. With a two-level page table, 16-KB pages, and 4-byte entries, how many bits should be allocated for the top-level page table field and how many for the next level page table field? Explain.

13. Normally you have OS command to rename a file. This can be avoided by copying the file with that proposed name and later deleting the old file. What is the difference in comparison with a direct rename?

14. Removing files create holes on the disk – with more holes, average file access time increases due to more seek and latency. To impress the potential buyer, you design a new OS which does disc compaction after every 10 removals. Take, 8 GB disk, average file size is 80 KB, seek time is 7 ms and latency is 1 ms and the disk is always half-filled. Also note that the transfer time is 80 MB/sec. Find the reason (Calculate compaction time) to fire you even after proposing a unique OS.

15. A system has four processes (A, B, C and D) and five allocatable resources.
    The current allocation and maximum needs are as follows:

	Allocated	Maximum	Available
A	1 0 2 1 1	1 1 2 1 3	0 0 x 1 1
B	2 0 1 1 0	2 2 2 1 0	
C	1 1 0 1 0	2 1 3 1 0	
D	1 1 1 1 0	1 1 2 2 1	

    What is the smallest value of x for which this is a safe state?
    [Hint: create the Need matrix and test for x = 0, 1, 2, … to see which can run to completion and see the available vector leading to completion of further processes or not]

   Signature of the student