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## **TCS-502**

**B. TECH. (CS) (FIFTH SEMESTER)**

**END SEMESTER**

**EXAMINATION, Dec., 2023**

**OPERATING SYSTEMS**

**Time : Three Hours**

**Maximum Marks : 100**

**Note :** (i) All questions are compulsory.

(ii) Answer any *two* sub-questions among (a), (b) and (c) in each main question.

(iii) Total marks in each main question are **twenty**.

(iv) Each sub-question carries 10 marks.

1. (a) We are given a computer system consisting of a CPU and a disk. We are told that each user request has a compute time of 80 milliseconds and on average

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generates 10 disk requests. We are further told that the service time at the disk is 10 ms :

(CO1)

- (i) Is this system compute bound or I/O bound ?
  - (ii) What is the maximum number of user requests that can be satisfied per second ?
  - (iii) If we are told that the disk is used 50% of the time, how many user requests are being satisfied per second ?
- (b) What are the differences between Batch processing system and Real Time processing system ? What inconveniences that a user can face while interacting with a computer system, which is without an operating system ?
- (c) What are the two models of inter-process communication ? What are the strengths and weaknesses of the two approaches ?

(CO1)

(3)

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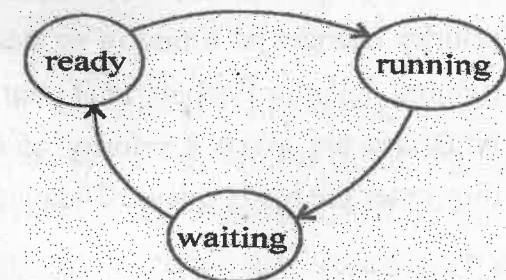
2. (a) The following program consists of 3 concurrent processes and 3 binary semaphores. The semaphores are initialized as  $S_0 = 1$ ,  $S_1 = 0$  and  $S_2 = 0$ .

(CO2)

Process P0	Process P1	Process P2
<pre>while (true) {     wait (S0);     print '0'     release (S1);     release (S2); }</pre>	<pre>wait (S1); release (S0);</pre>	<pre>wait (S2); release (S0);</pre>

How many times will process P0 print '0' ? Explain in detail.

- (b) Consider an operating system with a process state transition diagram given below, answer the questions. (CO2)



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- (i) A transition diagram illustrate the three state transitions. Explain under what condition each transitions occur.
- (ii) The diagram shows three process states. In theory, with three states there can be six transitions (i.e. a transition from any state to another, which yields, six transition total). However, there are only three transition shown. Are there any circumstances in which the other three transitions might occur, and why?
- (c) Consider a pre-emptive. priority scheduling algorithm based on dynamically changing priorities. Larger priority numbers imply higher priority. When a process is waiting for the CPU (in the ready queue, but not running), Its priority changes at a rate of  $\alpha$ ; when it is running, its priority changes at a rate  $\beta$ . All processes are given a priority of 0 when they enter the ready queue. The parameters

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$\alpha$  and  $\beta$  can be set to give many different scheduling algorithms : (CO2)

- (i) What is the algorithm that results from  $\beta > \alpha > 0$  ?
- (ii) What is the algorithm that results from  $\alpha < \beta < 0$  ?
3. (a) What do you understand by the term deadlock ? What are the major conditions of deadlock ? Elaborate.

Consider the following snapshot of a system : (CO3)

	Allocation				Max			
	A	B	C	D	A	B	C	D
P <sub>0</sub>	3	0	1	4	5	1	1	7
P <sub>1</sub>	2	2	1	0	3	2	1	1
P <sub>2</sub>	3	1	2	1	3	3	2	1
P <sub>3</sub>	0	5	1	0	4	6	1	2
P <sub>4</sub>	4	2	1	2	6	3	2	5

Using the banker's algorithm, determine whether or not each of the following states is unsafe. If the state is safe, illustrate the order in which the processes may

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complete. Otherwise, illustrate why the state is unsafe.

(i) Available = (0, 3, 0, 1)

(ii) Available = (1, 0, 0, 2)

(b) Consider single level paging. There are 2048 frames in main memory and page size is 12 bits. The page no. is of 16 bits.

(CO3)

(i) Draw the virtual address format and physical address format (single level paging is used)

(ii) Find the size of memory (in bytes)

(iii) Find the max. size of process

(iv) Suppose the page table has to be stored in memory equal to the space taken up by 1 page, then what should be the page table entry size ?

(c) What do you understand by the term TLB ? Explain with the help of a diagram. Consider a single level aging scheme with a TLB. Assume no page fault occurs. It

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takes 100 ns to access the physical memory. If TLB hit ratio is 60% and effective memory access time is 160 ns, find TLB access time. (CO3)

4. (a) Suppose that a disk drive has 5,000 cylinders, numbered 0 to 4,999. The drive is currently serving a request at cylinder 2,150, and the previous was at cylinder 1,805. The queue of pending requests, in FIFO order, is  
2069, 1212, 2296, 2800, 544, 1618, 356, 1523, 4965, 3681

Starting from the current head position. what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk-scheduling algorithms ? Where required consider head moving to larger track : (CO4)

(i) FCFS

(ii) SSTF

(iii) SCAN

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(iv) LOOK

(v) C-SCAN

(b) Explain the following terms : (CO4)

(i) File concept and access methods.

(ii) Disk structure with diagram.

(c) Consider a 500 GB hard disk having 32 KB block sizes. The size of the block pointer is 2 bytes. File allocation table based file system is used to keep track of allocated blocks on Hard disk. Then :

(CO4)

(i) What will be the total no. of entries in the FAT ?

(ii) Find the size of the file allocation table (FAT) in Megabytes (MB).

(iii) How many HDD blocks are needed to store FAT ?

(iv) How much percentage of HDD is used to store FAT ?

(v) Find the maximum size of a file that can be stored on this disk as per above FAT ?

5. (a) The directory structure of a Linux operating system could include files corresponding to several different file systems, including the Linux/proc file system. How might the need to support different file-system types affect the structure of the Linux kernel ? (CO5)

(b) Answer the following : (CO5)

(i) Distinguish between internal and external commands with examples.

(ii) Describe significance syntax and examples of given commands :

ls -il, umask, chmod and chown

(c) Explain Shell script and its execution. Write a shell script to check whether a file exists or not. If it exists check whether it is readable, writeable or both. (CO5)