

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, ALLAHABAD

End-Semester Examination, November 2018

Date of Exam: 27.11.2018 (2nd Session)

Course Title: Operating Systems; Course Code: IOPS332C

Program: B.Tech. (ECE)/Dual Degree 3rd Semester

Paper Setter: Dr. S. MAITY

Full Marks: 75

Duration: 3 Hours

Answer all of the following questions. Clearly write question numbers in your answers.

1. State TRUE/FALSE with proper justification. 5 x 3 = 15 Marks.

- A.** In order to perform a synchronous I/O operation, at least two different ISR routines are invoked.
- B.** A short-term scheduler is supposed to take more 'optimal decisions' as compared to a long-term scheduler.
- C.** Direct communication primitive provides an always ready connection between any two processes P and Q. Hence, it is always advantageous over indirect communication primitive.
- D.** Deferred thread cancellation, although costly but, is safer than asynchronous thread cancellation.
- E.** In non-preemptive CPU scheduling, the CPU scheduler is invoked only when a process switches from the 'running' state.

2. A. Consider the following snapshot of a system:

	Allocation					Max.					Available			
	A	B	C	D		A	B	C	D		A	B	C	D
P0	0	0	1	2		0	0	1	2		1	5	2	0
P1	1	0	0	0		1	7	5	0					
P2	1	3	5	4		2	3	5	6					
P3	0	6	3	2		0	6	5	2					
P4	0	0	1	4		0	6	5	6					

Answer the following questions using the banker's algorithm. Clearly show all the calculation steps in support of your answers:

- a. What is the content of the matrix *Need*?
- b. Is the system in a safe state?
- c. If a request from process P1 arrives for (0,4,2,0), can the request be granted immediately?

1 + 4 + 3 = 8 Marks.

B. O/S literature has proposed several approaches for handling deadlocks, viz., deadlock prevention, deadlock avoidance, deadlock detection & recovery. Still why some O/Ss, like UNIX, apply no deadlock handling mechanism and prefer to simply restart the system when it enters into deadlock?

4 Marks.

3. A. Why dynamic linking cannot be implemented without mode switching? 2 Marks.

B. If page-size is 10 words, then calculate the physical address corresponding to the logical address 35 for a process whose Page Table is [3, 1, 7, 4]. **3 Marks.**

C. If the largest logical address for the above process is 36 then, write down the physical address space for the process? What amount of memory is wasted by the process due to internal fragmentation? **2 + 1 = 3 Marks.**

D. Can we use the 'valid-invalid' bit in the page tables of processes as an alternative to the use of page-table limit register (PTLR)? Explain. **2 Marks.**

E. What difficulty would you face in implementing shared pages in a system that uses an inverted page table? **2 Marks.**

4. A. In evaluating the performance of some page replacement algorithm, do you think a page-reference string generated by a uniform random number generator, like the rand() function in C, is equally appropriate as a reference string obtained directly from the computer H/W? **2 Marks.**

B. Consider the following page reference string:

1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6

How many page faults would occur for the following page replacement algorithms if we allocate 3 frames per process? **3 + 3 = 6 Marks.**

- Least Frequently Used Replacement.
- Optimal Page Replacement.

C. What is the cause of thrashing? **2 Marks.**

D. Compare between paging and segmentation. **2 Marks.**

5. A. What are the relative advantages and disadvantages of providing mandatory locks in place of advisory locks whose usage is left to user's discretion? **4 Marks.**

B. What is File Allocation Table (FAT) and what is its role in file management? **4 Marks.**

C. What is hierarchical model of file system? Explain its different modules. **4 Marks.**

6. A. Consider a hard disk with 16 recording surfaces (0-15) having 16384 cylinders (0-16383) and each cylinder contains 64 sectors (0-63). Data storage capacity in each sector is 512 bytes. Data are organized cylinder-wise and the addressing format is (cylinder number, surface number, sector number). A file of size 42797 KB is stored in the disk and the starting disk location of the file is <1200, 9, 40>. What is the cylinder number of the last sector of the file, if it is stored in a contiguous manner? Clearly show your calculation steps. **4 Marks.**

B. For each of the four disk-arm scheduling algorithms you have studied, state one advantage and one disadvantage. **4 Marks.**

C. Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The queue of pending requests, in FIFO order, is:

86, 1472, 913, 1784, 948, 1507, 1023, 1750, 130

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 disk-scheduling algorithms you have mentioned in the previous question? **4 Marks.**

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