Question Paper

Exam Date & Time: 01-Jul-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH. (INFORMATION TECHNOLOGY) DEGREE EXAMINATIONS - JUNE/JULY 2023
SUBJECT: ICT 2258/IT-2258 OPERATING SYSTEMS
(MAKEUP)

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

Missing data, if any, may be suitably assumed.

1A) 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, 1470, 913, 1774, 948, 1509, 1022, 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 following disk scheduling
(a) SCAN (b) LOOK (c) C-SCAN (5)

1B) Consider a file currently consisting of 100 blocks. Assume that the filecontrol block (and the index block, in the case of indexed allocation) is already in memory. Calculate how many disk I/O operations are required for contiguous, linked, and indexed (single-level) allocation strategies, if, for one block, the following conditions hold. In the contiguous-allocation case, assume that there is no room to grow at the beginning but there is room to grow at the end. Also assume that the block information to be added is stored in memory.
(i) The block is added at the beginning.
(ii) The block is added in the middle.
(iii) The block is added at the end. (3)

1C) Suppose that the following processes arrive for execution at the times indicated. Each process will run the listed amount of time. In answering the questions, use nonpreemptive scheduling and base all decisions on the information you have at the time the decision must be made. (2)

PROCESS	ARRIVAL TIME	BURST TIME
P1	0.0	8
P2	0.4	4
P3	1.0	1

i) What is the average turnaround time for these processes with the FCFS scheduling algorithm?
ii) What is the average turnaround time for these processes with the SJF scheduling algorithm?

2A) A system has a physical memory of 128 KB and uses a paging scheme with a page size of 2 KB. If the system uses an inverted page table and each entry in the table requires 16 bytes, what is the maximum number of page table entries that can be accommodated? (5)

2B) Consider a file system with a maximum file size of 1 GB and an i-node size of 256 bytes. If each i-node can store 12 direct block pointers, a single indirect block pointer, and a double indirect block pointer, what is the maximum number of blocks that a file can address directly? (3)

2C) Illustrates the steps used for translating logical address into physical address with suitable example and necessary diagram. (2)

3A) Assume that you have the following attributes for a virtual memory system. (5)

i) Three frames in Main Memory
ii) Two processes p1 and p2
iii) Number of pages in Virtual memory are 6(A,B,C,D,E,F).
The page reference string encoded below has < process name-page name> For example < p1-A> means p1 process A page.
Page reference String: < p1-A>,< p2-B>,< p2-C>,< p1-B>< p2-A>,< p1-B>,< p2-D>,< p2-A>,< p1-B>,< p2-E>,< p2-F>,< p1-C>.
Show the frame contents and calculate page-fault rate for each of the following page replacement policies.
i) LRU (Global page replacement)
ii)FIFO (Local page replacement) Assume that process p1 is assigned 2 pages and p2 is assigned 1 page

3B) To transfer a 4KB block on a 5400 RPM disk with a 4ms average seek time, 1Gb/sec transfer rate with a 0.2ms controller overhead, what is the total average access time taken? (3)
Hint: 1GB=1048576KB.

3C) Consider a logical address space of 64 pages of 1KB each, mapped onto a physical memory of 32 frames. (2)
i) How many bits are there in the logical address?
ii) How many bits are there in the physical address?

4A) Consider a system with five processes P1 through P5 and three resource types x,y,z. Resource type x has 10 instances, y has 5 instances and type z has 12 instances. Suppose at time t_0 following snapshot of the system are given in Table 4A. (5)

Table 4A

Process	Allocation			Max		
	X	Y	Z	x	y	Z
P1	2	0	2	3	1	3
P2	1	0	3	2	0	4
P3	0	2	2	4	3	3
P4	4	3	3	5	3	3
P5	0	0	2	2	2	2

i) Check whether the system is in safe state. If so, obtain the safe sequence.
ii) Whether the additional requests for x and y from P1 can be granted or not.
iii) If process P3 requests (2,1,1), after step ii, can it be granted? If yes, obtain the safe sequence.

4B) Differentiate between system calls and function calls. Illustrate dual mode operation by showing the standard C library's system call. (3)

4C) A file system uses i-node structure which contains 8 direct block address, one indirect block, one double indirect and one triple indirect block address. The size of the disk block is 128bytes. The size of each block address is 8bytes. Find the maximum possible file size. (2)

5A) Code Q5A represents assembly language code for a pair of processes that share the variable result. The initial value of the *result* before execution of either process begins is 10. Here,*LD* loads the memory variable into the target register, the *ADD* instruction adds values, and *ST* stores the register value into the memory variable. If processes X and Y are run on a timesharing system, there are six possible orders in which the LD and ST instructions might be executed. For each of the orders, the final value of the counter variable could be 11, 12, or 13. i) Add semaphores (with initial values) so that the final value of the counter is 12. ii) Add semaphores (with initial values), so that the final value of the counter is not 13. iii) Add semaphores (with initial values), so that process X executes only after the execution of process 2. (5)

Process X:	Process Y:
X1: LD(result,R0)	Y1: LD(result,R0)
ADD (R0, 1)	ADD(R0, 2)
X2: ST(R0, result)	Y2: ST(R0, result)

Code Q5A.

5B) What type of OS is used in embedded system? Give its characteristics. (3)

5C)	With two examples, demonstrate two multithreading issues as compared to single-threaded applications.	(2)

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