SRM Institute of Science and Technology
College of Engineering and Technology
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Offline Mode
SET B

Academic Year: 2021-22 (EVEN) **Reg No:**

Test: CLA-T3 **Date:** 22.06.2022
Course Code & Title: 18CSC205J - Operating Systems **Duration:** 2 Period
Year & Sem: II Year / IV Sem **Max. Marks:** 50 Marks

Course Articulation Matrix: ***(to be placed)***

S.No.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	CO3	1	3		3								
2	CO4	1	3		3								
3	CO5	1	3	2	3								

Part – A (10 x 1 = 10 Marks)
Instruction: Answer all

Q. No	Question	Mark	BL	CO	PO	PI Code
1)	The situation where the processor spends most of its time swapping process pieces rather than executing instructions is called: a) Paging b) The Principle of Locality c) Thrashing d) Swapping Answer : c	1	1	3	1	1.6.1
2)	The hardware implementation of LRU page replacement policy can be done through: a) Counters b) RAM & Registers c) Stack & Counters d)Registers Answer : c	1	2	3	1	1.6.1
3)	Which is a technique to efficiently copy data resources in a computer system a) Copy-on-write b) Swapping c) Thrashing d) Paging Answer : a	1	2	3	1	1.6.1
4)	_____ algorithm associates with each page, the time when the page was brought into memory. a) Optimal page replacement b) FIFO c) LRU replacement algorithm d) Counting based replacement Answer : b	1	1	3	2	1.6.1
5)	Which of the following is the main drawback of FIFO page replacement algorithm? a) Requirement of large memory b) Frame allocation c) Reduction in multiprogramming d) Reduced optimality Answer : c	1	1	3	1	1.6.1
6)	Consider a disk queue with requests for I/O to blocks on cylinders. 98 183 37 122 14 124 65 67 Considering FCFS (first cum first served) scheduling, the total number of head movements is, if the disk head is initially at 53 is? a) 600 b) 620 c) 630 d) 640 Ans: d) 640	1	3	4	2	2.8.1

7)	Identify the tag used to call the file which is not the human readable name. a. File Name b. File Identifier c. Size d. Location Ans: b File Identifier	1	2	5	1	1.6.1
8)	Which is not executable file? a. .com b. .exe c. .bat d. .txt Ans: d) .txt	1	1	5	1	1.5.1
9)	Batch file is used to a. Run program b. Show the contents c. run commands automatically d. execute step by step Ans: C) . run commands automatically	1	2	5	2	2.5.1
10)	Swapping a. Works best with many small partitions b. Allows many programs to use memory simultaneously c. Allows each program in turn to use the memory d. Does not work with overlaying Ans: C Allows each program in turn to use the memory	1	1	5	1	1.5.1
PART B (4 X 5 = 20 Marks) **Instruction: Answer any 4**						
11)	How does the number page faults are reduced by the algorithm which uses both reference bit and modify bit? Explain with an example Enhanced second-chance algorithm • Improve algorithm by using reference bit and modify bit (if available) in concert • Take ordered pair (reference, modify) 1. (0, 0) neither recently used not modified – best page to replace 2. (0, 1) not recently used but modified – not quite as good, must write out before replacement 3. (1, 0) recently used but clean – probably will be used again soon 4. (1, 1) recently used and modified – probably will be used again soon and need to write out before replacement • When page replacement called for, use the clock scheme but use the four classes replace page in lowest non-empty class – Might need to search circular queue several times	5	4	3	2	1.6.1
12)	Given: Memory access time = 200 ns Average page-fault service time = 8 ms Calculate the effective access time when one access out of 1,000 causes a page fault. Also explain how to reduce performance degradation of the memory access	5	2	3	1	1.6.1

	• Memory access time = 200 nanoseconds • Average page-fault service time = 8 milliseconds • EAT = (1 – p) x 200 + p (8 milliseconds) = (1 – p x 200 + p x 8,000,000 = 200 + p x 7,999,800 • If one access out of 1,000 causes a page fault, then EAT = 8.2 microseconds.					
13)	Why must the bit map for file allocation be kept on mass storage rather than in main memory? Explain in detail. Answer: Bit Vector Frequently, the free-space list is implemented as a bit map or bit vector. Each block is represented by 1 bit. If the block is free, the bit is 1; if the block is allocated, the bit is 0. For example, consider a disk where blocks 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 17, 18, 25, 26, and 27 are free and the rest of the blocks are allocated. The free-space bit map would be 00111100111111000110000011100000 ... The main advantage of this approach is its relative simplicity and its efficiency in finding the first free block or n consecutive free blocks on the disk. Indeed, many computers supply bit-manipulation instructions that can be used effectively for that purpose. One technique for finding the first free block on a system that uses a bit-vector to allocate disk space is to sequentially check each word in the bit map to see whether that value is not 0, since a 0-valued word contains only 0 bits and represents a set of allocated blocks. The first non-0 word is scanned for the first 1 bit, which is the location of the first free block. The calculation of the block number is (number of bits per word) × (number of 0-value words) + offset of first 1 bit	5	2	5	3	3.7.1
14)	List the different file operations and explain each of them. The six basic file operations are: (3 marks) • Creating a file • Writing a file • Reading a file • Repositioning within a file • Deleting a file • Truncating a file Explanation of each operation (2 marks)	5	1	5	1	1.6.1
15)	The SSTF disk scheduling favor the middle cylinders over the innermost and outermost cylinders. Justify this statement Answer: The center of the disk is the location having the smallest average distance to all other tracks. Thus the disk head tends to move away from the edges of the disk. Here is another way to think of it. The current location of the head divides the cylinders into two groups. If the head is not in the center of the disk and a new request arrives, the new request is more likely to be in the group that includes the center of the disk; thus, the head is more likely to move in that direction.	5	3	4	4	4.6.4
PART C (2 X 10 = 20 Marks) **Instruction: Answer All**						

<table>
<tr>
<td>16)
A)</td>
<td>Given the reference string: 0 1 5 3 0 1 4 0 1 5 3 4. Find the number of page faults for frame size 3 and frame size 4. Does the increase in number of frames reduces page fault. If not state the reason
Case 1: Number of frames = 3
<table><tr><td>Request</td><td>0</td><td>1</td><td>5</td><td>3</td><td>0</td><td>1</td><td>4</td><td>0</td><td>1</td><td>5</td><td>3</td><td>4</td></tr><tr><td>Frame 3</td><td></td><td></td><td>5</td><td>5</td><td>5</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>3</td><td>3</td></tr><tr><td>Frame 2</td><td></td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>5</td><td>5</td><td>5</td></tr><tr><td>Frame 1</td><td>0</td><td>0</td><td>0</td><td>3</td><td>3</td><td>3</td><td>4</td><td>4</td><td>4</td><td>4</td><td>4</td><td>4</td></tr><tr><td>Miss/Hit</td><td>Miss</td><td>Miss</td><td>Miss</td><td>Miss</td><td>Miss</td><td>Miss</td><td>Miss</td><td>Hit</td><td>Hit</td><td>Miss</td><td>Miss</td><td>Hit</td></tr></table>Number of Page Faults = 9
Case 2: Number of frames = 4
<table><tr><td>Request</td><td>0</td><td>1</td><td>5</td><td>3</td><td>0</td><td>1</td><td>4</td><td>0</td><td>1</td><td>5</td><td>3</td><td>4</td></tr><tr><td>Frame 4</td><td></td><td></td><td></td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>5</td><td>5</td><td>5</td></tr><tr><td>Frame 3</td><td></td><td></td><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>5</td><td>1</td><td>1</td><td>1</td><td>1</td></tr><tr><td>Frame 2</td><td></td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>4</td></tr><tr><td>Frame 1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>4</td><td>4</td><td>4</td><td>4</td><td>3</td><td>3</td></tr><tr><td>Miss/Hit</td><td>Miss</td><td>Miss</td><td>Miss</td><td>Miss</td><td>Hit</td><td>Hit</td><td>Miss</td><td>Miss</td><td>Miss</td><td>Miss</td><td>Miss</td><td>Miss</td></tr></table>Number of Page Faults = 10
Therefore, in this example, the number of page faults is increasing by increasing the number of frames hence this suffers from Belady'sAnomaly.</td>
<td>10</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1.6.1</td>
</tr>
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<td>16) B)</td>
<td>Define thrashing. Justify the statement “ “Working set model reduces thrashing of locality based references.” Describe how to set optimal working set window size with an example

In case, if the page fault and swapping happens very frequently at a higher rate, then the operating system has to spend more time swapping these pages. This state in the operating system is termed thrashing. Because of thrashing the CPU utilization is going to be reduced.</td>
<td>10</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1.6.1</td>
</tr>
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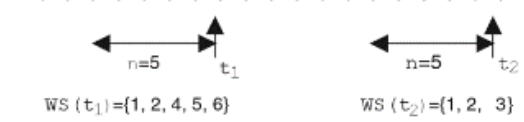
Working-set Model

Working set model is an approach used to prevent thrashing and is based on the assumption of locality. Locality is defined as the set of pages that are actively used together. Working-set model uses a parameter (say, n) to define the **working set** of a process, which is the set of pages that a process has referenced in the latest n page references. The notion of working set helps the operating system to decide how many frames should be allocated to a process.

Since the locality of process changes from time to time, so as the working set. At a particular instant of time, a page in active use is included in the working set while a page that was referenced before the most recent n references is not included. For example, consider the sequence of memory references given in the figure.



Working-set Model

If the value of n is 5, then the working set at time t_1 is {1, 2, 4, 5, 6}. At time t_2 the working set would be {1, 2, 3}.

Note that the performance of working set strategy depends to a greater extent on the value of n. A too large value of n would result in over commitment of memory to a process. The working set may contain those pages which are not supposed to be referenced. In contrast, a too small value of n would cause under commitment of memory, which in turn results in high page fault rate and consequently thrashing. Thus, the value of n must be carefully chosen for the accuracy of working set strategy.

The most important property of working-set is its size, as it indicates the number of frames required by a process. The knowledge of working set size of each process helps to compute the total number of frames required by all the running processes. For example, if WSS_i denotes the working set size of a process P_i at time t, then the total number of frames required (say, V) at time t can be calculated as:

$$V = \sum WSS_i$$

Now, thrashing can be prevented by ensuring V<=F where F denotes the total number of available frames in memory at time t.

The idea behind the working set strategy is to have the working set of processes in memory at all times in order to prevent thrashing. For this, the operating system continuously monitors the working set of each running process and allocates enough frames to accommodate its working set size. If still some frames are remaining, the operating system may decide to increase the degree of multiprogramming by starting a new process. On the other hand, if at any instant the operating system finds V>F, it selects some process and suspends its execution, thereby, decreasing the degree of multiprogramming. In totality, the degree of multiprogramming is kept as high as possible and thus, working set strategy results in optimum CPU utilization.

17))	*The disk contains 100 cylinders. The request to access the cylinder occur in the following sequence:* *4,34,10,7,19,73,2,15,6,20. Currently the head is at position 50. The time taken for single head movement is 2 ms. Calculate the total time taken according to scheduling policies FCFS, SSTF, SCAN and LOOK* *Answer:* *Calculate total head movement for all algorithm (8 marks)* ***Head Movement**:* *FCFS: 276* *SSTF: 127* *SCAN: 131* *LOOK: 127* ***Total Time Taken***	10	5	5	3	3.6.1

	FCFS: 276 X 2 = 552ms *SSTF: 127 X 2 = 254ms* *SCAN: 131 X 2 = 262ms* *LOOK: 127 X 2 = 254ms* *Multiply the total head movement with 2 ms for all algorithm(2 marks)* *(OR)*					
17) B)	Write the significance of file protection in muti user environment. Explain different remote file system sharing with an example for each model • For multiple users-File sharing, file naming and file protection is a challenging and important task. • In order to handle this, file access control and protection need to be done. • If a user wants to share a file with other user, proper protection schemes need to be followed. • Whenever a file is shared for various users on distributed systems , it must be shared across distributed systems. • In order to share and distribute files, Network File System (NFS) is used. • For single user system ,the system need to maintain many files and directory attributes. File sharing-Remote File Systems- Client Server Model • The machine containing the files is the **server**, and the machine seeking access to the files is the **client**. • The server can serve multiple clients, and a client can use multiple servers, depending on the implementation details of a given client–server facility. • Example: – **NFS** is standard UNIX client-server file sharing protocol – **CIFS** is standard Windows protocol – Standard operating system file calls are translated into remote calls **File sharing -Distributed Information Systems** • Distributed Information Systems **(distributed naming services)** such as LDAP, DNS, NIS, Active Directory implement unified access to information needed for remote computing • Examples: • Other distributed information systems provide ***user name/password/user ID/group ID*** space for a distributed facility. • UNIX systems have employed a wide variety of distributed information methods. • Sun Microsystems introduced **yellow pages** (since renamed **network information service**, or **NIS**), and most of the industry adopted its use. **File Sharing -Failure Modes** • All file systems have failure modes – For example corruption of directory structures or other non-user data, called metadata • Remote file systems add new failure modes, due to network failure, server failure • Recovery from failure can involve state information about status of each remote request • Stateless protocols such as NFS v3 include all information in each request, allowing easy recovery but less security.	10	3	5	3	3.6.1