## **Question Paper**

Exam Date & Time: 18-Jun-2022 (02:00 PM - 05:00 PM)



## FOURTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, JUNE 2022 OPERATING SYSTEMS [ICT 2258]

Marks: 50

1)

Duration: 180 mins.

(5)

Instructions to Candidates:

## Answer ALL questions Missing data may be suitably assumed

Consider the set of processes and their priority (smaller the number, higher the priority) and their burst time in milliseconds as given in the Table-1. Schedule the set of processes using a priority scheduling algorithm. Draw a Gantt chart. Calculate the waiting time and turnaround time for each of the processes, average waiting time and average turnaround time. Assume all processes arrive at the same time in the order of P1, P2, P3, P4, P5.

	Table-1	
Process	Burst time	Priority
P1	8	4
P2	6	1
P3	1	2
P4	9	2
P5	3	3

- B) With the help of the suitable code snippet, describe how the Swap () instruction can be used to (3) provide mutual exclusion that satisfies the bounded-waiting requirement.
- C) At one time, virtual memory system designers were advised to bias page replacement algorithms in (2) favour of the pages that had not been modified against modified pages. The result of this suggestion was the unfortunate behaviour of program code pages (which tend to be some of the only pages that are not modified) being moved out of main memory to secondary storage. Describe the rationale for the original suggestion of paging unmodified pages first.
- 2) Consider a system employing a deadlock-avoidance scheme for single instance of each resource (5) type. Let P1, P2 and P3 be three processes in the system. Let P1 declare that it may request resources W, X and Y; P2 declare that it may request resources X, Y and Z; P3 declare that it may request resources W, Y and Z. Construct the resource-allocation graph by considering the resource requests declared by P1, P2 and P3. Consider each of the following pairs of resource requests to determine whether requests can be granted without a deadlock possibility. Explain.
  - a) P1 requesting X and P2 requesting Z
  - b) P2 requesting Y and P3 requesting W
  - c) P1 requesting Y and P3 requesting W
  - d) P1 requesting X and P2 requesting Y
  - B) Discuss any one large class of concurrency-control synchronization problem using appropriate

(3)

code snippets.

C) Discuss how client-server computing environment differ from peer-to-peer computing environment. (2)

//Remainder section

3)

A)

Given below are the incorrect solutions to critical section problem between 2 processes Justify why (5) the solutions are incorrect highlighting the disadvantages. Write the correct solution to critical section problem for synchronization between P1 and P2 using P1\_CS, P2\_CS, and favored

variables (with suitable initial values). A) P1\_CS=FALSE; P2\_CS=FALSE void P1() void P2() ł ł while true do while true do { ł while P1\_CS do; while P2\_CS do; P1\_CS=TRUE; P2\_CS = TRUE; //CS1; //CS1; P1\_CS=FALSE; P2\_CS = FALSE;

//Remainder section

3

B) PN=1: void P1() void P2() ł ł while true do while true do { { while PN=2 do; while PN=1 do; //CS1; //CS1; PN=2; PN=1; //Remainder section //Remainder section 3

3

C) P1_CS=FALSE; P2_CS=FALSE	·
void P1()	void P2()
{	{
while true do	while true do
{	{
P1_CS=TRUE	P2_CS=TRUE
while P2_CS do;	while P2_CS do;
//CS1;	//CS1;
P1_CS=FALSE;	P2_CS=FALSE;
//Remainder section	//Remainder section
}	}
}	}

For each of the memory management schemes given below, describe if you would expect to find:

(1) A translation lookaside buffer (TLB)

(2) Internal fragmentation

(3) External fragmentation

The memory management schemes are:

a) Base and bound.

b) Segmentation

c) Paging

Explain the answer with respect to each of the memory management scheme.

- C) Explain the benefits and drawbacks of one-to-one and many-to-one multithreading models.
- A system implements a paged virtual address space for each process using a one-level page table. (5)
   The maximum size of virtual address space is 16MB. The page table for the running process

(2)

(3)

B)

A)	includes the following valid entries (the notation indicates that a virtual page maps to the given page frame, i.e, it is located in the given frame number):		
	Virtual page 2 $\rightarrow$ page frame 4		
	Virtual page 4 $\rightarrow$ page frame 9		
	Virtual page 1 $\rightarrow$ page frame 2		
	Virtual page 3 $\rightarrow$ page frame 16		
	Virtual page 0 $\rightarrow$ page frame 1		
	The page size is 1024 bytes and the maximum physical memory size of the machine is 2MB.		
	<ul> <li>A) How many bits are required for each virtual address?</li> <li>B) How many bits are required for each physical address?</li> <li>C) What is the maximum number of entries in a page table?</li> <li>D) To which physical address will the virtual address 1524<sub>10</sub> translate?</li> <li>E) Which virtual address will translate to physical address 1024<sub>10</sub>?</li> </ul>		
B)	Differentiate the role of the following schedulers	(3)	
	<ul><li>A) Short term scheduler</li><li>B) Medium term scheduler</li><li>C) Long term scheduler</li></ul>		
C)	What are the problems associated with usage of semaphores? Justify the answer.	(2)	
	Provide the monitor based solution to dining Philosophers problem.	(5)	
A)			
B)	Assume that you have been given a system with the following attributes:	(3)	
	<ul> <li>I) A paged virtual memory system with 6 pages (A, B, C, D, E, F)</li> <li>II) Two processes (P1, P2)</li> <li>III) A physical memory system that can hold three pages.</li> </ul>		
	The memory reference is encoded as < Process-Page>. For example < P1-A> means Process P1 references page A. The reference string is:		
	< P1-A> < P1-B> < P2-C> < P2-F> < P2-E> < P1-A> < P2-D> < P2-E> < P1-A> < P1-B>		
	Find the number of page faults when the system uses the following replacement strategies:		
	A) LRU - a global page replacement policy using LRU replacement algorithm		
	B) Opt - a global page replacement policy using Optimal replacement algorithm		
	C) FIFO - a Local page replacement policy using FIFO replacement algorithm. Under the local replacement policy P1 has initial resident set of 2 pages and P2 has initial set of 1 page.		
C)	A real-time system consists of three periodic tasks T1(14,2), T2(7,1) and T3(4,2) given in (period, execution time) format. Check whether the tasks can be scheduled using EDF. Show the Gantt chart if the tasks can be scheduled using EDF scheduling algorithm.	(2)	

5)

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