KONERU LAKSHMAIAH EDUCATION FOUNDATION
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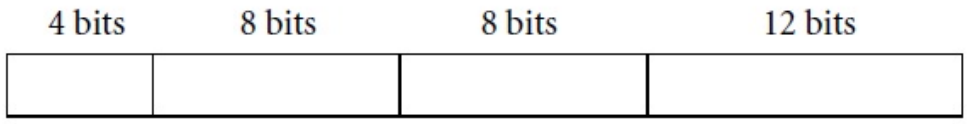
B.Tech - Odd Sem : Semester in Exam-II
Academic Year:2020-2021

19CS2106S - OPERATING SYSTEMS DESIGN - S

Set No: 1

Time: **Max.Marks: 50**

S.NO	Answer All Questions	Choice	Options	Marks	CO
1.	Illustrate hardware-based dynamic relocation, Hardware Requirements and Operating System Responsibilities	choice Q-2		4.5Marks	CO3
2.	Please give your version of the realloc() call using system calls to allocate the swap space for the process to be swapped out. You can descript it with a C-like algorithm			4.5Marks	CO3
3.	a) Some UNIX systems have a vfork system call that creates a new process but requires that the child does not return from the function that called vfork and that it invokes only the exit or execve system calls. Why is this curious system call a useful addition? How and why do modern CPUs reduce the need for vfork? b) Give a solution to deallocate the swap space on the disk in detail.	choice Q-4		8Marks	CO3
4.	a) KERNBASE limits the amount of memory a single process can use, which might be irritating on a machine with a full 4 GB of RAM. Would raising KERNBASE allow a process to use more memory? b) How does the kernel ensure consistency of the TLB and the virtual address cache during an exec system call? Since the UNIX kernel is nonpaged, what could lead to a change in a TLB entry for a kernel page?			8Marks	CO3
5.	Answer the following	choice Q-6		12.5Marks	CO3
5.A.	In xv6, explain first address space using Paging. Illustrate creating and running first process.			6Marks	CO3
5.B.	For a given virtual address in a binary number, write and explain OS Handled translation lookaside buffer control flow algorithm			6.5Marks	CO3
6.	Answer the following			12.5Marks	CO3
6.A.	Consider a three-level page table organization as shown in the figure below. If a program is 4 Giga bytes, what is the total space needed for its page table (that is, the total space needed by directories and partial page tables)? 			6Marks	CO3
6.B.	a) If you have to design a virtual memory management with demand paging, please design an algorithm to manipulate the hash frame table for the used frames. b) For the problem at hand, the main memory management policy is a page-based virtual memory and the replacement algorithm is NFU. Page reference counters are two bits. If a counter reaches its maximum, it will no longer be incremented. If the number of page frames is three, how many page faults are generated for the given page trace? 2 1 1 2 2 3 0 3 1 2 0 2 4			6.5Marks	CO3
7.	Express the reasons for insisting on doing these two actions: (1) test (or load) the content of a memory location and (2) set its value to one using one machine instruction, in order for this instruction to be useful in implementing mutual exclusion. List Locks in xv6.	choice Q-8		4.5Marks	CO4
8.	Given that you can create multiple threads to perform different tasks within a program, explain why you might still need to use fork. List 5 pthread functions.			4.5Marks	CO4
9.	What three segments are usually found in the memory allocated to a process? Distinguish between an activation record and a stack frame. What is contained in a stack frame? How long does a stack frame last? Illustrate backtrace and Depict stack frames for a sample C program which call 3 user defined functions and malloc function.	choice Q-10		8Marks	CO4
10.	Many systems classify library functions as thread-safe or thread-unsafe. What causes a function to be unsafe for use by a multithreaded application? Illustrate the implementation of concurrent linked list that only allows one thread to access any given node at any instant.			8Marks	CO4
11.	Answer the following	choice Q-12		12.5Marks	CO4
11.A.	Compare the IPC functionality provided by pipes and message queues. What are the advantages and drawbacks of each? When is one more suitable than the other? Illustrate message queue data structures by giving algorithm for msgget()			6Marks	CO4
11.B.	Write a program to demonstrate deadlock using semaphores. How can the IPC_NOWAIT flag be used to prevent deadlocks when using semaphores? Illustrate system V semaphores data structures by giving algorithm for semget()			6.5Marks	CO4
12.	Answer the following			12.5Marks	CO4
12.A.	How do condition variables avoid the lost wakeup problem? Give pseudocode to producer consumer problem using condition variables with multiple producer threads and single consumer thread.			6Marks	CO4
12.B.	i. If Resource 1 has one slot, it is represented by R1 -> 1.Given the following scenarios, determine if there is a dead lock by drawing a resource allocation graph. R1 -> 2, R2 -> 2, P1 holds R2 requesting R1, P2 holds R1, P3 holds R1 requesting R2, P4 holds R2. ii . Considering a system with five processes P1 through P5 and three resources of type A, B, C. Resource type A has 10 instances, B has 5 instances and type C has 7 instances. Suppose at time t0 following snapshot of the system has been taken: 1. what will be the content of the need matrix? 2. is the system in a safe state? if yes then what is the safe sequence? 3. what will happen if process p3 requests one additional instance of resource type C and two instances of resource type A ?			6.5Marks	CO4

Process	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P1	2	0	2	6	5	3	1	0	1
P2	0	1	1	2	2	1			
P3	2	0	0	2	0	1			
P4	3	3	1	4	3	3			
P5	2	1	2	4	2	2			

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