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1 a

1. Print the following Pattern

A 1 a B 2 b C 3 c ... Y 25 y Z 26 z

Using any one of the following concepts

a. Multiprocesses (Hint: using 3 child processes)

Description:

For printing the given pattern using multi-processing, three children of the parent process are to be created and each will print a part of the pattern. 1st child will print from A to z, 2nd from 1 to 26 and 3rd from a to z one by one and hence they need to be synchronize. For the process synchronization semaphores are used.

With three three threads have to be created and are synchronized using mutex

2 b Describe the Buddy's Algorithm for Memory Allocation and

Deallocation along with an example and implement it in C or C++.

Description:

For the memory allocation, a list is maintained of the available nodes in the powers of 2.

Hence if the memory size is of 1Mb there would be 20 free lists for the different blocks of 1 byte, other for 2 byte other for 4 byte so on and so forth.

When a request for the allocation is received the smallest block which is bigger than the request block is searched for and if that block is available the allocation is done. If the request is for 30 kb and the block of 32 kb is available the memory is allocated else the other large enough block is found out and then splitted into 2 out of which one is added in the free list and from the other we traverse down till we get the request memory space and allocate the memory. If space is not available the memory is not allocated and null is returned.

Now for the deallocation when the request comes up, first we check if the address entered is correct or not. If not correct we will inform the user about it.

If the request is correct than we will trace the block of the size and then search the free list to see if the buddy of the lock is also free. If free we will merge them and place the whole block in the free list.

Example: Suppose 128 KB memory is available. So there will be 8 free lists and the last list will have the value (0, 127) and other null.

Now suppose the request is to allocate 16 bytes.

No such free list hence we split 0,17 into 2, add 64-127 in free list and track 0-63. No such block found in it so again split it into 2 add 32-63 in free list and check 0-32 and again split it into 2. 0-15 is allocated the memory for 16 bytes and 16-31 in added in free list.

Now again request is for 16 bytes. Here as the block is available we will directly allocate it.

3. Describe what is Producer Consumer Problem and its solution in

detail using Semaphores and Mutex and implement it in C.

Description:

So the problem is that when one or more producers try to generate the data and place in the array and at the same time the consumer is taking or reading the data from the same array. So if the sequencing of the events change there will be error in the final output. So only one of the consumer or producer should be able to access the array at a time.

The problem is solved using semaphores and mutex.

The mutex is used for the mutual exclusion. With the mutex only one process will be able to use the shared buffer at a time.

2 semaphores will be used. One will track the empty space in the buffer and the other will track the filled space in the buffer.