**Operating Systems Design** :

Tutorial 04 - Memory management system

**Question 1.** Memory management is the process of the computer memory, but and assigning blocks to various running programs to optimize overall system performance. There are 4 types of memory allocation schemes in memory management : single-user systems, fixed partitions, dynamic partitions and relocatable dynamic partitions. A logical address describes an address generated by the CPU while a program is running, “logical address space” is used for the set of all logical addresses generated by a programs perspective.

A physical address describes a physical location of required data in the memory, “physical address space” is used for the set of all physical address mapped to corresponding logical addresses.

**Question 2.** A non-contiguous memory management allows a process to acquire the several memory blocks at the different location in the memory according to its requirement and reduces the memory wastage. The example we saw in the course is paged memory allocation (divides each incoming job into pages of equal size).

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**Question 3***.* The virtual memory is a memory management capability (or a storage allocation scheme) in which secondary memory can be addressed as though it were part of the main memory. Virtual memory allows programs to be executed even though they are not stored entirely in memory. It helps to eliminate the need for entire program to reside in memory during execution and also to remove the restriction of storing programs contiguously.

**Question 4.** There are 4 methods of allocation schemes : First Fit (when partition is allocated from the first availability in the Main Memory), Best Fit (will check everything and find the smallest sufficient partition among the free available partition), Worst Fit (will find the largest sufficient in the free partitions available in the Main Memory) and Next Fit (a derivative of First Fit, will find the first sufficient partition from the last allocation point).

**Question 5.**

*i)* Best fit : Partition 6

*ii)* First fit : Partition 3

*iii)* Worst fit : Partition 4

*iv)* Next fit : Partition 3

**Question 6.** It is an excessive amount of page swapping between main memory and secondary storage (caused when a page is removed from memory but is called back shortly thereafter).

**Question 7.**

*i)* The relocatable dynamic partitions is a memory manager that relocates programs to gather together all of the empty blocks. To improve memory usage, the system compacts the empty blocks to make one block of memory large enough to accommodate some (or all) the jobs waiting to get in, using compacting and relocating methods.

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*ii)* The compaction must be carried out when a certain percentage of memory is busy, when there are jobs waiting to get in and after a prescribed amount of time has elapsed.

**Question 8.** So that the memory manager can recognize two neighboring partitions, the addresses are compared and knowing that each is on its own page, looking at the address we can quickly know which page they belong. If they are consecutive, they are neighbours. In other words, we can look at the size of the first block and its address, and get from this data (via concatenation) the address of the second block. Ex:

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**Question 9.**

|  |  |
| --- | --- |
| *Page number* | *Reference-Bits after shifting* |
| 0 | 0001 0000 |
| 1 | 1110 1000 |
| 2 | 0000 1100 |
| 3 | 0011 1110 |
| 4 | 0000 0001 |

*Least Recently Used :* Page 0

*Most Recently Used :* Page 4

*Most Frequently Used :* Page 3

*Least Frequently Used :* Pages 0 or 4