

# **Assignment for KSA-01**

## **CSE-309 (Operating System)**

### **Instructions:**

- You must answer in total of 14 questions.
- Assignment must be hand-written.

**Chapter 1 & 2 (ans any 4 questions)**

1. Write the names of different OS services for the User and the System.
2. Explain system call and generate sequence of system calls for copying a file's content (in.txt) to another file (out.txt).
3. Write down different types of system call.
4. Discuss how operating systems are used in a variety of OS computing environments/OS Environments.
5. Explain the user view and system view relating them with the computer system components and their connection (with diagram).

(Hints: [pdf link chapter 1](#) - figure 1 and figure 2).

6. Explain interrupts and their importance in short.
7. Why we need both volatile (such as RAM) and non-volatile (such as HDD) memory in a computer system. Can any computer system be built only using either volatile or non-volatile? Provide explanation of your answer discussing different types of volatile and non-volatile memory.
8. What is DMA (Direct Memory Access) and why we need it ?
9. Explain cache and caching.
10. Usually a program is a binary executable file stored on the disk; for example, a.out or prog.exe. To run on a CPU, the program must be loaded into memory and placed in the context of a process. Explain the whole process from source program to program in memory using the concept of linkers and loaders.
11. User mode can not directly access system resources. System control must be switched from user to kernel mode for this purpose. For example, in class, we talk about printf() system call to access the I/O (chapter 2 pdf). In the same way, a process can make request and grant additional dynamic memory allocation using system call. Explain this process (using function malloc()).
12. In previous question, elaborate on the criteria employed by the operating system to determine which processes receive approval for memory allocation requests and which processes are refused system calls for memory allocation.
13. "Kernel mode is the privileged mode but user mode is the safest mode"  
- analyze the statement.

## Chapter 3 (ans any 4 questions)

1. Explain layout of a process in memory using the following image.

```
#include <stdio.h>
#include <stdlib.h>

int x;
int y = 15;

int main(int argc, char *argv[])
{
    int *values;
    int i;

    values = (int *)malloc(sizeof(int)*5);

    for(i = 0; i < 5; i++)
        values[i] = i;

    return 0;
}
```

2. Explain different types of process states using state transition diagram of a process.
3. Each process is represented in the operating system by a process control block (PCB), also called a task control block. It contains many pieces of information associated with a specific process. Explain those information. Elaborate on the relationship between PCBs and context switches in the operating system.
4. We have explored various methods for selecting the next process from the waiting queue in the running state:
  - Choosing the process that arrived first.
  - Opting for the process with the shortest CPU time requirement.
  - Prioritizing processes based on their assigned priority levels.
  - Selecting each process after a predetermined time interval.

Now, explain why we need process scheduling and its impact for making a system highly efficient.

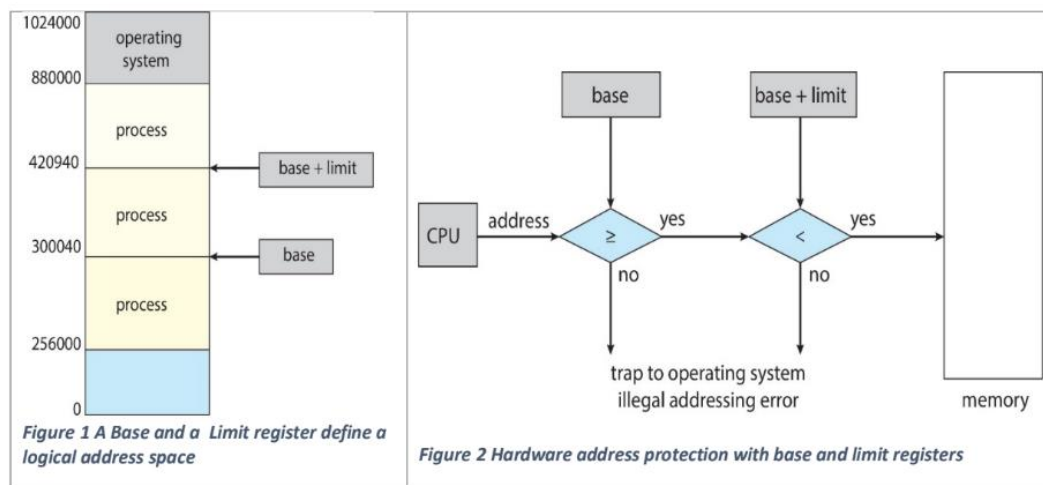
5. Processes executing concurrently in the operating system may be independent or cooperating. A process is independent if it does not share data with any other processes executing in the system. A cooperating process can share data, affect or be affected by other processes executing in the system. Explain the reasons of providing environment for process cooperation & two fundamental models of IPC.

6. How a large number of contexts-switching / switching can badly impact system performance.

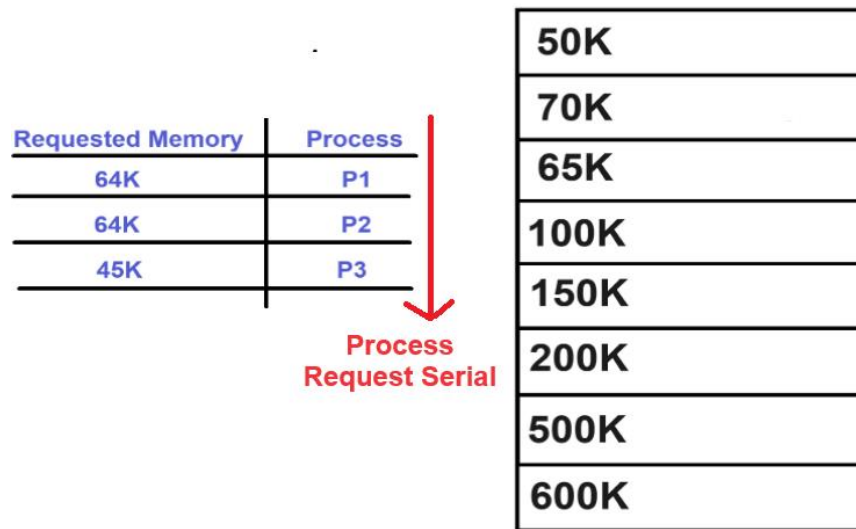
## Main Memory & Virtual Memory

**(ans any 6 questions where 4,6,7,13 is must)**

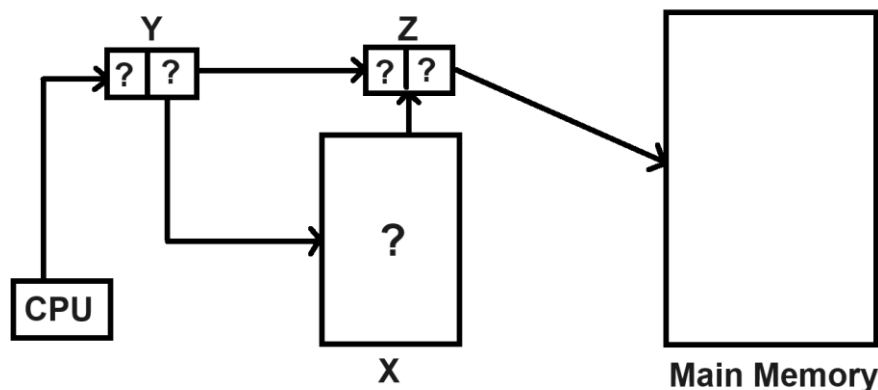
1. Write the definitions of symbolic address, logical address, physical address & address binding.
2. Explain hardware protection in memory so that a process can not access memory of other processes using the following image.



3. Explain two advantages and disadvantages of contiguous and non-contiguous memory allocation techniques.
4. Explain best fit, worst fit, first fit and next fit for the following image.



5. Explain the following image using the concept of memory allocation in main memory. Identify X, Y, Z and explain these. Hints: X is a data structure. How can you apply Transition Look Aside Buffer (TLB) to reduce access time (EMAT) for the following process.



6. TLB can efficiently reduce the overall access time or EMAT for paging. Now, if main memory access time,  $M = 100$  pico-second; TLB access time  $t = 10$  pico-second. Now calculate EMAT for:
- A system S1 with Hit Rate/Ratio = 90%
  - A system S2 with Hit Rate/Ratio = 40%

Now, explain which system is comparatively more efficient than the other one.

7. A system with logical address = 64 bits, Page size = 16kb, physical memory size = 8 gb, page table entry size = 3B. Now calculate:
- Number of entries for a single level page table
  - Number of entries for an inverted page table
  - Number of frames for an inverted page table
  - Size of the page table for a single level page table
  - Size of the page table for a inverted page table
  - Number of bits needed for logical address and physical address
  - Number of bits needed for page number (p), page offset (d), frame offset (f).
8. A system with logical address space = 4GB, physical address space = 256MB, Frame Size = 4KB, Page table entry size = 2B. Calculate the level of paging needed for this system.
9. If the number of page faults continuously increases in a system as the number of requests increases, then the CPU utilization or system performance continuously degrades. Analyze why page faults occur in a system if we want to maximize the degree of multiprogramming. Explain this with a proper graph.
10. “Though an inverted page table can reduce memory usages, but also lead to higher time complexity” - analyze the statement mentioning advantages and disadvantages of inverted page table.
11. “Virtual memory is an illusion to the programmer” - explain in 5 lines.
12. Explain page replacement or page swapping in terms of demand paging.
13. Given reference string: 7,0,1,2,0,3,0,4,2,3,0,3,1,2,0 and main memory has 3 frames which are initially empty.
- Apply FIFO page replacement algorithm
  - Apply optimal page replacement algorithm
  - Apply LRU page replacement algorithm
  - Apply second chance/clock page replacement algorithm

We know that,

$$\text{Hit Rate or Hit Ratio} = \frac{\text{Total number of memory accesses or requests}}{\text{Number of page hits}} \times 100\%$$

Calculate the hit ratios for the aforementioned page replacement algorithms and determine which algorithm yields the highest efficiency for a given reference string.