Assignment No 06: Write a program to simulate Memory placement strategies for Best fit, First fit, Next fit,Worst fit.

1.1 Prerequisite:

Basic concepts of Memory Management, Different types of Memory Management.

1.2 Theory:

- **Memory Management**

  Memory management is the process of controlling and coordinating a computer's main memory. It ensures that blocks of memory space are properly managed and allocated so the operating system (OS), applications and other running processes have the memory they need to carry out their operations.

  Memory management takes into account the capacity limitations of the memory device itself, deallocating memory space when it is no longer needed or extending that space through virtual memory. Memory management strives to optimize memory usage so the CPU can efficiently access the instructions and data it needs to execute the various processes.

- **Memory Allocation**

  Memory allocation is a process by which computer programs and services are assigned with physical or virtual memory space.

  Memory allocation is the process of reserving a partial or complete portion of computer memory for the execution of programs and processes. Memory allocation is achieved through a process known as memory management.
  There are four memory allocation algorithms:
  1. Single contiguous allocation.
  2. Partitioned allocation.
  3. Paged memory management.
  4. Segmented memory management.

- **Partitioning Allocation:**

  Memory is divided into different blocks or partitions. Each process is allocated according to the requirement.

- **Partitioning Allocation Algorithm:**

A partition allocation method is considered better if it avoids internal fragmentation. When its time to load a process into the main memory and if there is more than one free block of memory of sufficient size then the OS decides which free block to allocate.

There are four algorithms which are implemented by the operating system in order to find out the holes in the linked list and allocate them to processes.

The explanation about each of the algorithm is given below:

1. First fit Algorithm:

In the first fit approach is to allocate the first free partition or hole large enough which can accommodate the process. It finishes after finding the first suitable free partition.

- **ADVANTAGES:**

  Fastest algorithm because it searches as little as possible.

- **DISADVANTAGES:**

  The remaining unused memory areas left after allocation become waste if it is too smaller. Thus, request for larger memory requirement cannot be accomplished.

- **ALGORITHM:**

  Step no 01: Get number of processes and number of blocks.
  Step no 02: After that get the size of each block and process requests.
  Step no 03: Now allocate processes
  if (block size >= process size)
  // allocate the process
  Else
  //move on to next block
  Step no 04: Display the processes with the blocks that are allocated to a respective process.
  Step no 05: Stop.

2. Best fit Algorithm:

The best fit deals with allocating the smallest free partition which meets the requirement of the requesting process. This algorithm first searches the entire list of free partitions and considers the smallest hole that is adequate. It then tries to find a hole which is close to actual process size needed.

- **ADVANTAGES:**

  Memory utilization is much better than first fit as it searches the smallest free partition first available.

- **DISADVANTAGES:**
  It is slower and may even tend to fill up memory with tiny useless holes.

- **ALGORITHM:**
  Step 1: Get number of processes and number of blocks.
  Step 2: After that get the size of each block and process requests.
  Step 3: Then select the best memory block that can be allocated using the above definition.
  Step 4: Display the processes with the blocks that are allocated to a respective process.
  Step 5: Value of fragmentation is optional to display to keep track of wasted memory.
  Step 6: Stop.

3. Worst fit Algorithm:

In worst fit approach is to locate largest available free portion so that the portion left will be big enough to be useful. It is the reverse of best fit.

- **ADVANTAGES:**
  Reduces the rate of production of small gaps.

- **DISADVANTAGES:**
  It is a process requiring larger memory arrives at a larger stage then it cannot be accommodated as the largest hole is already split and occupied.

- **ALGORITHM:**
  Step no 01: Input memory block with a size.
  Step no 02: Input process with size.
  Step no 03: Initialize by selecting each process to find the maximum block size that can be assigned to the current process.
  Step no 04: If the condition does not fulfil, they leave the process.
  Step no 05: If the condition is not fulfilled, then leave the process and check for the next process.
  Step no 06: Stop.

4. Next fit Algorithm:

Next fit is a modified version of first fit. It begins as first fit to find a free partition. When called next it starts searching from where it left off, not from the beginning.

- **ADVANTAGES:**
  Next fit tries to address this problem by starting the search for the free portion of parts not from the start of the memory, but from where it ends last time.

Next fit is a very fast searching algorithm and is also comparatively faster than First fit and Best fit Memory management algorithms.

- **DISADVANTAGES:**
  Next fit does not scan the whole list, it starts scanning the list from the next node. The idea behind the next fit is the fact that the list has been scanned once therefore the probability of finding the hole is larger in the remaining part of the list.

- **ALGORITHM:**
  Step no 01: Enter the number of memory blocks.
  Step no 02: Enter the size of each memory block.
  Step no 03: Enter the number of processes with their sizes.
  Step no 04: Start by selecting each process to check if it can be assigned to the current memory block.
  Step no 05: If the condition in step 4 is true, then allocate the process with the required memory and check for the next process from the memory block where searching was halted, not from the starting.
  Step no 06: If the current memory size is smaller, then continue to check the next blocks.
  Step no 07: Stop.

CONCLUSION: Hence we successfully designed First fit algorithm, Best fit algorithm, Worst time algorithm, Next time algorithm.