DHA SUFFA UNIVERSITY
Department of Computer Science
CS-2004L
Operating Systems
Fall 2020

Lab 12 – Memory Management Algorithms (Best, First and Worst)

Objective(s):

- Understanding of Memory Management.
- Understanding of First Fir, Best Fit and Worst Fit algorithm.
- To implement First Fit, Best Fit and Worst Fit algorithm.

Memory Management

Memory management is the process of controlling and coordinating computer memory, assigning portions called blocks to various running programs to optimize overall system performance. Memory management resides in hardware, in the OS (operating system), and in programs and applications.

Basic Requirements that Drive Memory Design

- The primary memory access time must be as small as possible. This need influences both software and hardware design.
- The primary memory must be as large as possible. Using virtual memory, software and hardware can make the memory appear to be larger than it actually is.
- The primary memory must be cost-effective. The cost cannot be more than a small percentage of the total cost of the computer.

Memory Manager

The purpose of the memory manager is

- To allocate primary memory space to processes
- To manage the process address space into the allocated portion of the primary memory.
- To minimize access times using a cost-effective amount of primary memory

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Memory Management Algorithm

In an environment that supports dynamic memory allocation, the memory manager must keep a record of the usage of each allocatable block of memory. This record could be kept by using almost any data structure that implements linked lists. An obvious implementation is to define a free list of block descriptors, with each descriptor containing a pointer to the next descriptor, a pointer to the block, and the length of the block. The memory manager keeps a free list pointer and inserts entries into the list in some order conducive to its allocation strategy. A number of strategies are used to allocate space to the processes that are competing for memory.

1. Best Fit Algorithm
2. First Fit Algorithm
3. Worst Fit Algorithm

First Fit Algorithm

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 small. Thus requests for larger memory requirements cannot be accomplished.

ALGORITHM:

1. Start the program.
2. Get the number of memory partitions and their sizes.
3. Get the number of processes and values of block size for each process.
4. Initialize all memory blocks as free.
5. Start by picking each process and check if it can be assigned to the current block.
6. If size-of-process <= size-of-block if yes then assign and check for the next process.
7. If not then keep checking the further blocks.
8. Stop the program.

Example:

Input:

BlockSize[] = {100, 500, 200, 300, 600}

ProcessSize[] = { 212, 417, 112, 426}

Output:

Process No.	Process Size	Block No.
1	212	2
2	417	5
3	112	3
4	426	Not Allocated

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 the actual process size needed.

ALGORITHM:

1. Start the program.
2. Get the number of memory partitions and their sizes.
3. Get the number of processes and values of block size for each process.
4. Initialize all memory blocks as free.
5. Start by picking each process and find the minimum block size that can be assigned to current process i.e., find min(bockSize[1], blockSize[2],……blockSize[n]) > processSize[current], if found then assign it to the current process.
6. If not then leave that process and keep checking the further processes.

7. Stop the program.

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.

Example:

Input:

BlockSize[] = {100, 500, 200, 300, 600}

ProcessSize[] = { 212, 417, 112, 426}

Output:

Process No.	Process Size	Block No.
1	212	4
2	417	2
3	112	3
4	426	5

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Worst Fit Algorithm

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

Advantage

Reduces the rate of production of small gaps.

Disadvantage

If a process requiring larger memory arrives at a later stage then it cannot be accommodated as the largest hole is already split and occupied

ALGORITHM:

1. Start the program.
2. Get the number of memory partitions and their sizes.
3. Get the number of processes and values of block size for each process.
4. Initialize all memory blocks as free.
5. Searches the memory blocks for the largest hole and allocates it to the process.
6. If not then leave that process and keep checking the further processes.
7. Stop the program.

Example:

Input:

BlockSize[] = {100, 500, 200, 300, 600}

ProcessSize[] = { 212, 417, 112, 426}

Output:

Process No.	Process Size	Block No.
1	212	5
2	417	2
3	112	4
4	426	Not Allocated

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ASSIGNMENT # 12

Write a C++/Java code to implement all three algorithms of memory management in which you get the input from the users and display the table in output.

SUBMISSION GUIDELINES

- Take a screenshot of each task (code and output).
- Place all the screenshots in a single word file labeled with Roll No and Lab No. e.g. **'cs172xxx_Lab01'.**
- Convert the file into PDF.
- Make a folder labeled with Roll No, place the pdf and .cpp/.java/.sh files in this folder
- Submit the file at LMS