SCHOOL OF ENGINEERING AND APPLIED SCIENCE
B-tech (ICT) Semester-V
Operating Systems

Project Report

<u>Memory Management</u>

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● Introduction :-

Memory Management is one of the services provided by OS which is needed for Optimized memory usage of the available memory in a Computer System. The concept of dynamic partitioning is that, when a new process is created, it divides the memory according to the size of the process. In our project we will show memory allocation for process according to the different memory allocation algorithms (i.e Best fit, Next fit, first fit). We are taking inputs for process and blocks from the file. Process gets allocated using respective algorithms. We are showing the statistical difference between these 3 algorithms. We are performing error handling for some incorrect input. We are also displaying the amount of memory wasted due to external fragmentation and internal fragmentation caused during the process.

For this purpose OS uses 3 methods :-
1. First Fit.
2. Best Fit.
3. Worst Fit.

First Fit check the blocks in a sequential manner which means if we pick the first process then it will compare its size with first block size. If it is less than size of block it is allocated. otherwise we move to the second block and so on. When the first process is allocated we move on to the next process until all processes are allocated.

Best fit uses the best memory block based on the Process memory request. In best fit implementation the algorithm first selects the smallest block which can adequately fulfill the memory request by the respective process. Because of this

memory is utilized optimally but as it compares the blocks with the requested memory size it increases the time requirement and hence slower than other methods. It suffers from Internal Fragmentation which simply means that the memory block size is greater than the memory requested by the process, then the free space gets wasted.

Worst Fit allocates a process to the partition which is largest sufficient among the freely available partitions available in the main memory. If a large process comes at a later stage, then the memory will not have space to accommodate it.
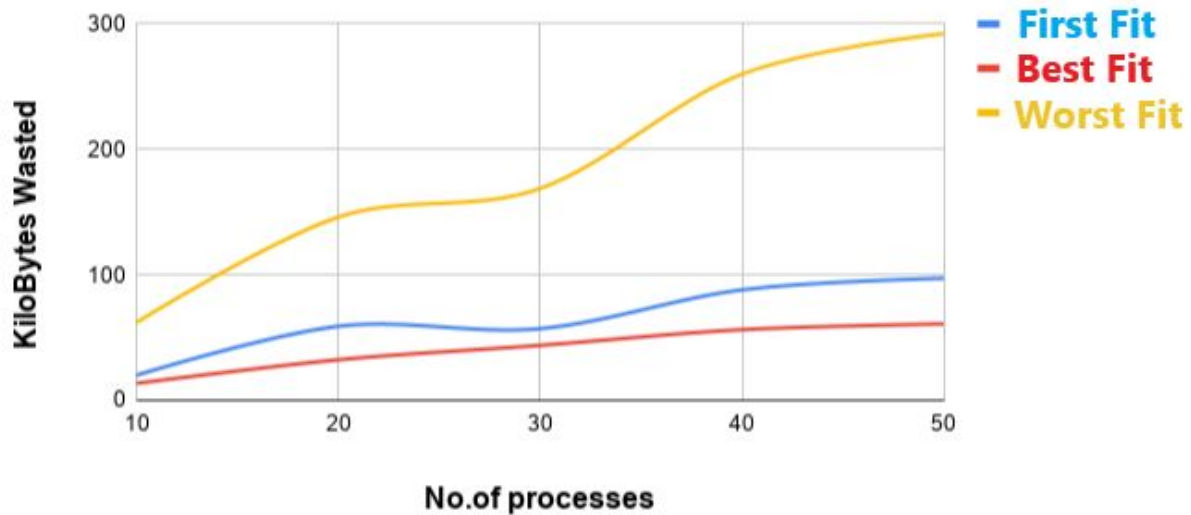
- ● **Implementation :-**

First of all, we implemented multi-threading to generate random process sizes and random block sizes and stored it in their respective files. We approximately created 70,000 random process and random free block sizes. We have implemented these algorithms in both Fixed Partitioning and Dynamic Partitioning.

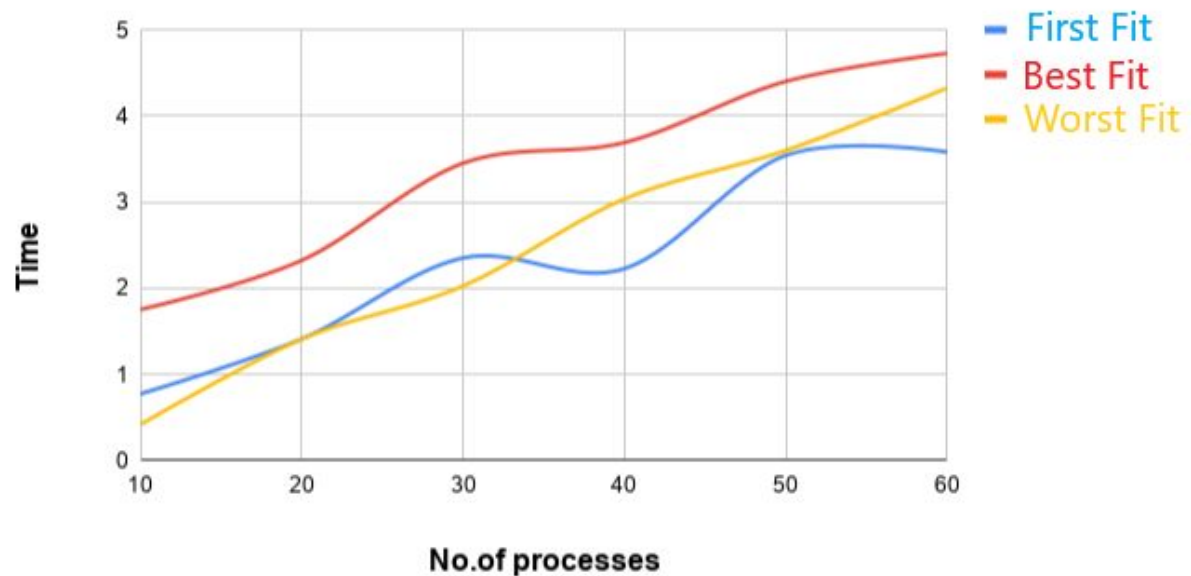Now to implement our memory allocation algorithms we took our input by reading from file and calculated following terms :

1. Allocation of Memory.
2. Memory wasted in each algorithm(Fragmentation).
3. Number of process that are left unallocated.
4. Time taken to implement each algorithm.
5. Statistical Analysis of time taken by each algorithm.
6. Statistical Analysis of memory wasted by each algorithm.

Memory wasted due to Dynamic partitioning (External Fragmentation))

Legend:
- First Fit
- Best Fit
- Worst Fit

Y-axis: KiloBytes Wasted (0, 100, 200, 300)
X-axis: No.of processes (10, 20, 30, 40, 50)

Time Comparison for memory allocation algorithms. (Dynamic Partitioning)

Legend:
- First Fit
- Best Fit
- Worst Fit

Y-axis: Time (0, 1, 2, 3, 4, 5)
X-axis: No.of processes (10, 20, 30, 40, 50, 60)

- **Conclusion :-**

From all the analysis, the results were clear that Best Fit takes more time to execute but is also memory efficient. Memory wastage by Best fit is least but also allocation of memory is too time consuming.

First fit is one of the efficient algorithms for memory allocation as it does not search all memory blocks every time. It just allocates the process as soon as it finds allocable memory block.

Also Dynamic Partitioning is better than Fixed Partitioning because fixed partitioning lacks in efficient use of memory.

- **Screen-Shots :-**

```
1) First Fit Dynamic Partioning

Process No. Process Size    Block no.    Memory Wasted
    1          24654            2         29609        1036
    2          20785            1         24079        3294
    3          16231            3         17865        1634
    4          29528      Not Allocated
    5          22584            6         26254        3670
    6          29230      Not Allocated
    7          10870            4         21457        4665
    8          3919             2         29609        1036
    9          5922             4         21457        4665
   10          32324      Not Allocated
No of unallocated processes are : 3
The memory wasted due to external fragmentation is : 20000
Time taken : 1.069
```

2) Best Fit Dynamic Partioning

Process No.	Process Size	Block no.	Block Size	Memory Wasted
1	24654	6	26254	1600
2	20785	4	21457	672
3	16231	9	16234	3
4	29528	2	29609	81
5	22584	1	24079	1495
6	29230	Not Allocated		
7	10870	3	17865	3076
8	3919	3	17865	3076
9	5922	5	9459	3537
10	32324	Not Allocated		

No of unallocated processes are : 2
Amount of memory wasted due to external fragmentation is : 13540
Time taken : 2.086

3) Worst Fit Dynamic Partioning

Process No.	Process Size	Block no.	Block Size	Memory Wasted
1	24654	2	29609	4955
2	20785	8	27600	6815
3	16231	6	26254	10023
4	29528	Not Allocated		
5	22584	1	24079	1495
6	29230	Not Allocated		
7	10870	4	21457	10587
8	3919	7	20135	16216
9	5922	3	17865	11943
10	32324	Not Allocated		

No of unallocated processes are : 3
Amount of memory wasted due to external fragmentation is : 62034
Time taken : 0.862

● **References :-**

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