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CSE 3320 – 003

04/14/2023

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Summary

The purpose of this assignment is to implement the functionality of malloc, calloc, and realloc using different algorithms which include: First Fit, Best Fit, Worst Fit, and Next Fit. Each of these algorithms, including the implementations of calloc and realloc, must be tested with a series of tests provided by the instructor. We also provide statistics that indicate different events that occurred when malloc was implemented and these statistics indicate how many times malloc and free was called, how many times a block was reused, how many times a block was split, how many coalesces occurred, how many blocks exist, how much memory did user requested, and the maximum size of the heap. We must also test our program by creating our own tests and must test them against the malloc provided by the system from a performance view.

Description of Algorithms

First Fit – The program shall return a block that fits the requested size and returns the first block it finds

Next Fit – The program shall return the block that fits the requested size and starts its search where it left before.

Worst Fit - The program searches the entire linked list of memory and finds the block that leaves the most amount of space in that block.

Worst Fit - The program searches the entire linked list of memory and finds the block that leaves the least amount of space in that block.

Statistics

- Num_mallocs - Number of times the user calls malloc successfully
- Num_frees - Number of times the user calls free successfully
- Num_reuses - Number of times we reuse an existing block
- Num_grows - Number of times we request a new block
- Num_splits - Number of times we split a block
- Num_coalsces - Number of times we coalesce blocks
- Num_blocks - Number blocks in free list
- Num_requested - Total amount of memory requested
- Max_heap - Maximum size of the heap

Statistics Table for my_test1.c

Num_mallocs	5
num_frees	3
Num_reuses	1
Num_grows	4
Num_splits	1
Num_coalesces	1
Num_blocks	2
Num_requested	13025
Max heap	8028

Statistics Table for my_test2.c

Num_mallocs	1031
Num_frees	1027

Num_reuses	2
Num_grows	1029
Num_splits	1
Num_coalesces	1024
Num_blocks	2
Num_requested	1053513
Max heap	1052116

Statistics Table for my_test3.c

Num_mallocs	7
Num_frees	4
Num_reuses	1
Num_grows	6
Num_splits	1
Num_coalesces	1
Num_blocks	3
Num_requested	19035
Max heap	15040

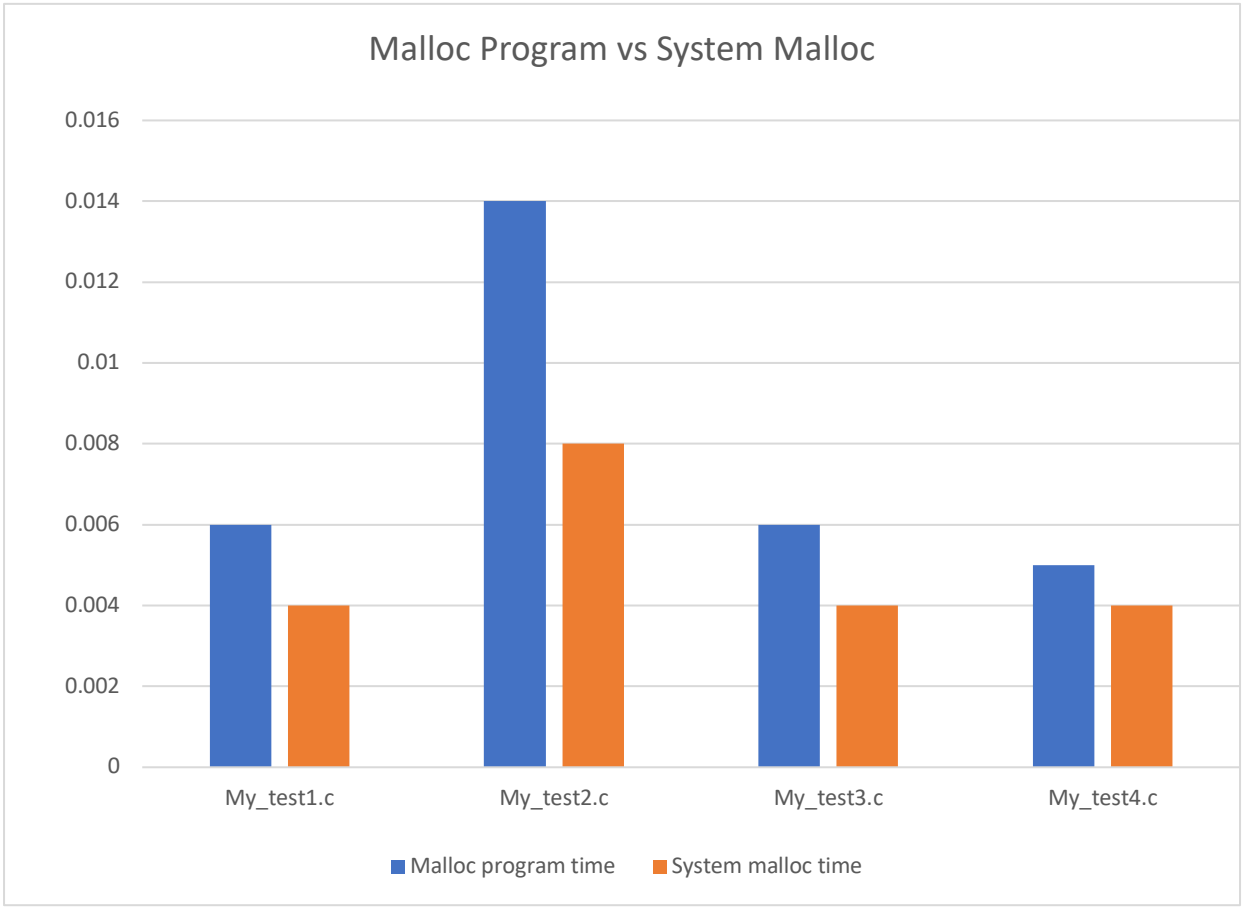
Statistics Table for my_test4.c

Num_mallocs	10
Num_frees	3
Num_reuses	2
Num_grows	8
Num_splits	0
Num_coalesces	0
Num_blocks	1
Num_requested	5139
Max heap	3648

Comparison time between System and My Malloc

Tests	Malloc program time	System malloc time
My_test1.c	0.006s	0.004s
My_test2.c	0.014s	0.008s
My_test3.c	0.006s	0.004s
My_test4.c	0.005s	0.004s

Graphical Comparison between Program vs System time



Conclusion

The purpose of this program was to test different algorithms of Best Fit, Next Fit, First Fit, and Worst Fit and implement these programs in order to run the malloc function. These algorithms were used to print their statistics which show the different events occurred while malloc function was being called. The run time of the malloc function was also used against the system malloc function to check the performance between the two. It was clear that the system malloc was functioning much faster than implemented program given the idea that system malloc has series of optimizations. Program mallox