

COMP 322/L—Introduction to Operating Systems and System Architecture

Assignment #4—Memory Allocation

Objective:

To simulate memory allocation with hole-fitting algorithms (First-fit, Best-fit) and implement deallocation and defragmentation of memory blocks.

Specification:

The program simulates memory allocation with a chosen hole-fitting algorithm (First-fit, Best-fit) and implements deallocation and defragmentation. A menu controls the operations, and each choice calls the appropriate procedure, where the choices are:

- 1) Enter parameters
- 2) Allocate memory for a block
- 3) Deallocate memory for a block
- 4) Defragment memory
- 5) Quit program and free memory

Assignment:

- The size of physical memory is represented by an integer *pm_size*.
- The allocated blocks are contained within a linked list, where each allocated block is a structure containing: (1) the id, (2) the starting address of the block, (3) the ending address of the block, and (4) a link to the next allocated block.
- Each allocation request prompts for: (1) the id and (2) the size of the new block. If the id is a duplicate and/or the remaining physical memory is not enough to fit the request, the request is rejected, and an appropriate message is displayed.
- Each deallocation request prompts for the id. If the id is invalid, the request is rejected.
- Defragmentation compacts the blocks to be contiguous, and coalesces the holes into one hole at the far-right end (highest memory addresses) of physical memory.

What NOT to do (any violation will result in an automatic score of 0 on the assignment):

- Do NOT modify the choice values (1,2,3,4,5) or input characters and then try to convert them to integers--the test script used for grading your assignment will not work correctly.
- Do NOT turn in an alternate version of the assignment downloaded from the Internet (coursehero, chegg, reddit, github, etc.) or submitted from you or another student from a previous semester.
- Do NOT turn in your assignment coded in another programming language (C++, C#, Java).

What to turn in:

- The source code as a C file uploaded to Canvas by the deadline of 11:59pm PST (-20% per consecutive day for late submissions, up to the 4th day—note 1 minute late counts as a day late, 1 day and 1 minute late counts as 2 days late, etc.)
- Make sure your code compiles with the online C compiler before submitting:
https://www.onlinegdb.com/online_c_compiler

Sample output

Memory allocation

- 1) Enter parameters
- 2) Allocate memory for block
- 3) Deallocate memory for block
- 4) Defragment memory
- 5) Quit program

Enter selection: 1

Enter size of physical memory: 1024

Enter hole-fitting algorithm (0=first fit, 1=best_fit): 1

Memory allocation

- 1) Enter parameters
- 2) Allocate memory for block
- 3) Deallocate memory for block
- 4) Defragment memory
- 5) Quit program

Enter selection: 2

Enter block id: 0

Enter block size: 128

| ID | Start | End |
|----|-------|-----|
|----|-------|-----|

| | | |
|---|---|-----|
| 0 | 0 | 128 |
|---|---|-----|

Memory allocation

- 1) Enter parameters
- 2) Allocate memory for block
- 3) Deallocate memory for block
- 4) Defragment memory
- 5) Quit program

Enter selection: 2

Enter block id: 1

Enter block size: 320

| ID | Start | End |
|----|-------|-----|
|----|-------|-----|

| | | |
|---|---|-----|
| 0 | 0 | 128 |
|---|---|-----|

| | | |
|---|-----|-----|
| 1 | 128 | 448 |
|---|-----|-----|

Memory allocation

- 1) Enter parameters
- 2) Allocate memory for block
- 3) Deallocate memory for block
- 4) Defragment memory
- 5) Quit program

Enter selection: 2

Enter block id: 2

Enter block size: 224

| ID | Start | End |
|----|-------|-----|
|----|-------|-----|

| | | |
|---|---|-----|
| 0 | 0 | 128 |
|---|---|-----|

| | | |
|---|-----|-----|
| 1 | 128 | 448 |
|---|-----|-----|

| | | |
|---|-----|-----|
| 2 | 448 | 672 |
|---|-----|-----|

Memory allocation

- 1) Enter parameters
- 2) Allocate memory for block
- 3) Deallocate memory for block
- 4) Defragment memory
- 5) Quit program

Enter selection: 2

Enter block id: 3

Enter block size: 288

| ID | Start | End |
|----|-------|-----|
| 0 | 0 | 128 |
| 1 | 128 | 448 |
| 2 | 448 | 672 |
| 3 | 672 | 960 |

Memory allocation

- 1) Enter parameters
- 2) Allocate memory for block
- 3) Deallocate memory for block
- 4) Defragment memory
- 5) Quit program

Enter selection: 3

Enter block id: 2

| ID | Start | End |
|----|-------|-----|
| 0 | 0 | 128 |
| 1 | 128 | 448 |
| 3 | 672 | 960 |

Memory allocation

- 1) Enter parameters
- 2) Allocate memory for block
- 3) Deallocate memory for block
- 4) Defragment memory
- 5) Quit program

Enter selection: 2

Enter block id: 4

Enter block size: 128

| ID | Start | End |
|----|-------|-----|
| 0 | 0 | 128 |
| 1 | 128 | 448 |
| 4 | 448 | 576 |
| 3 | 672 | 960 |

Memory allocation

- 1) Enter parameters
- 2) Allocate memory for block
- 3) Deallocate memory for block
- 4) Defragment memory
- 5) Quit program

Enter selection: 3

Enter block id: 1

| ID | Start | End |
|----|-------|-----|
| 0 | 0 | 128 |
| 4 | 448 | 576 |
| 3 | 672 | 960 |

Memory allocation

- 1) Enter parameters
- 2) Allocate memory for block
- 3) Deallocate memory for block
- 4) Defragment memory
- 5) Quit program

Enter selection: 2

Enter block id: 2

Enter block size: 224

| ID | Start | End |
|----|-------|-----|
| 0 | 0 | 128 |
| 2 | 128 | 352 |
| 4 | 448 | 576 |
| 3 | 672 | 960 |

Memory allocation

- 1) Enter parameters
- 2) Allocate memory for block
- 3) Deallocate memory for block
- 4) Defragment memory
- 5) Quit program

Enter selection: 2

Enter block id: 5

Enter block size: 64

| ID | Start | End |
|-------|-------|------|
| ----- | | |
| 0 | 0 | 128 |
| 2 | 128 | 352 |
| 4 | 448 | 576 |
| 3 | 672 | 960 |
| 5 | 960 | 1024 |

Memory allocation

- 1) Enter parameters
- 2) Allocate memory for block
- 3) Deallocate memory for block
- 4) Defragment memory
- 5) Quit program

Enter selection: 4

| ID | Start | End |
|-------|-------|-----|
| ----- | | |
| 0 | 0 | 128 |
| 2 | 128 | 352 |
| 4 | 352 | 480 |
| 3 | 480 | 768 |
| 5 | 768 | 832 |

Memory allocation

- 1) Enter parameters
- 2) Allocate memory for block
- 3) Deallocate memory for block
- 4) Defragment memory
- 5) Quit program

Enter selection: 5

Quitting program...