Assignment Information

Author: Ahmed Radwan

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Assignment: Assignment 4 - Malloc

Email: ahmedabdelwaha.radwan@wmich.edu

References (Can also be found above the function)

- Rounding a number to nearest multiple
  - https://stackoverflow.com/questions/3407012/c-rounding-up-to-the-nearest-multiple-of-a-number
  - Used in rounding the sizes to nearest multiple of 8 to ensure double alignment.
  - I didn't want to spend time thinking about math in the beginning 😄
- How to write to a file in Java
  - https://www.baeldung.com/java-write-to-file
  - Used to refresh my memory on how to write to files in Java.

What Language Have I Used?

- Java

What IDE Have I Used?

- Eclipse

How to Run?

- `Import...` the project into Eclipse
  - If `Import...` doesn't work, try opening the project using the `Open Projects from File System...`
- Place your input file in the root directory of the project or modify the current `input.txt` file
- Run the progam
- You will be asked to input the file name
  - Please type the file name with the extension (e.g.: `input.txt`)
- Then, you will be asked to choose the type of malloc: Implicit or Explicit
  - Implicit: 1
  - Explicit: 2
- Then, you will be asked to choose the type of search: First or Best fit

  - First: 1
  - Best: 2

Design & Implementation

Implicit

- The heap in my program is just an `int` array of words of size `1000`
  - The heap stores the first header at `1` for double alignment, skipping index zero `0`
  - The heap stores the first footer at `998` for double alignment, instead of index `999`
- The heap has the following structure
  - |`header`|`payload`|...|`payload`|`footer`|
- The payload is initialized with all `1`s in the beginning for reasons mentiond in the `Explicit` section

Explicit

- Mostly the same as Implicit
- The first index `0` is used to store the `root` of the free list
- The next free block has the following structure
  - |`header`|`prev`|`next`|`payload`|...|`payload`|`footer`|
  - The prev, in this case, points to `0`, which is the index of `root`
    - This is the reason why the payload is initialized with `1`s instead of `0`s
- A `prev` pointer always points to another free block's `prev` pointer
  - Except if it is the first free block, then it points to `root`
- A `next` pointer always points to another free block's `next` pointer
  - Except if it is the last, then its value is `-1`, as it doesn't point to anything
- The LIFO policy was used to free blocks
- When mallocing, if the last free block in the heap is allocated, sbrk is called
  - This is to ensure that `root` is always pointing to a free block