Data structure:

The data structure we used was just a list. It’s a doubly linked list. The list contains two pieces of information, the meta data, and the actual block of space. Every time data is requested, we always have the block of space and meta data which stores certain information about that block like the previous pointer, next pointer, size of that block and whether that block is used or not.

Table

Description automatically generated with medium confidence

Algorithms:

*Malloc:*

For malloc, we first check if the biggest possible block is big enough to fit the required size. If it is, we check if the size of that block is exactly equal to what was requested, in which case we do not do any splitting. If the size of the block is greater than what was requested, we do some splitting. So, the biggest possible block is a worst fit case.

Issue is that due to time constraints, the biggest possible block isn’t always accurate, so we go through all the free nodes only and find the BEST block that fulfills the size. We used a best fit algorithm to find the smallest possible block to fit the size to reduce as much fragmentation as possible. If we’re unable to find any block, we just throw an error message and return NULL. Otherwise, we check if the size of that block is exactly equal to what was requested, in which case we do not do any splitting. If the size of the block is greater than what was requested, we do some splitting.

For the splitting, we allocate the first x bytes of that block to return. The rest of that block will be given its own meta data. The size of that remaining block will be fixed and all the pointers will be correctly pointed to and from to make sure we don’t lose any data.

A picture containing diagram

Description automatically generated

*Free:*

Since we have a doubly linked list, freeing is simple and fast. We check if the current block has a free block before it. If it does, we do all the sizing additions and correct all the pointers. If the current block has a free block after it. If it does, we repeat the same process.

Chart

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