CSS 430

Prof: Yang Peng

Assignment 4a

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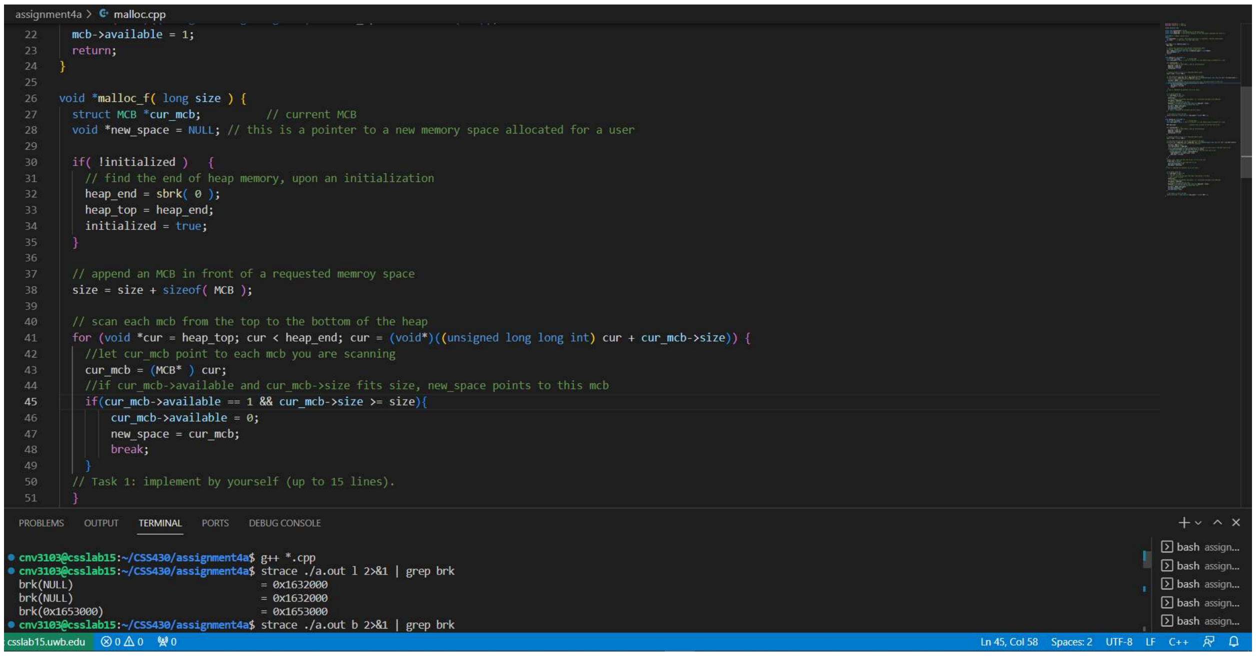
Assignment 4a Purpose:

This assignment implements malloc( ) and free( ) using the “sbrk” system function: change data segment size. Your implementation is based on the first-fit and the best-fit strategies. Since the original malloc/free functions in Linux use “brk” (an even more legacy function than sbrk), you can compare your own and the Linux-original implementations in terms of # brk system function calls.

Below are the screenshots and the challenges that I have faces during the assignment.

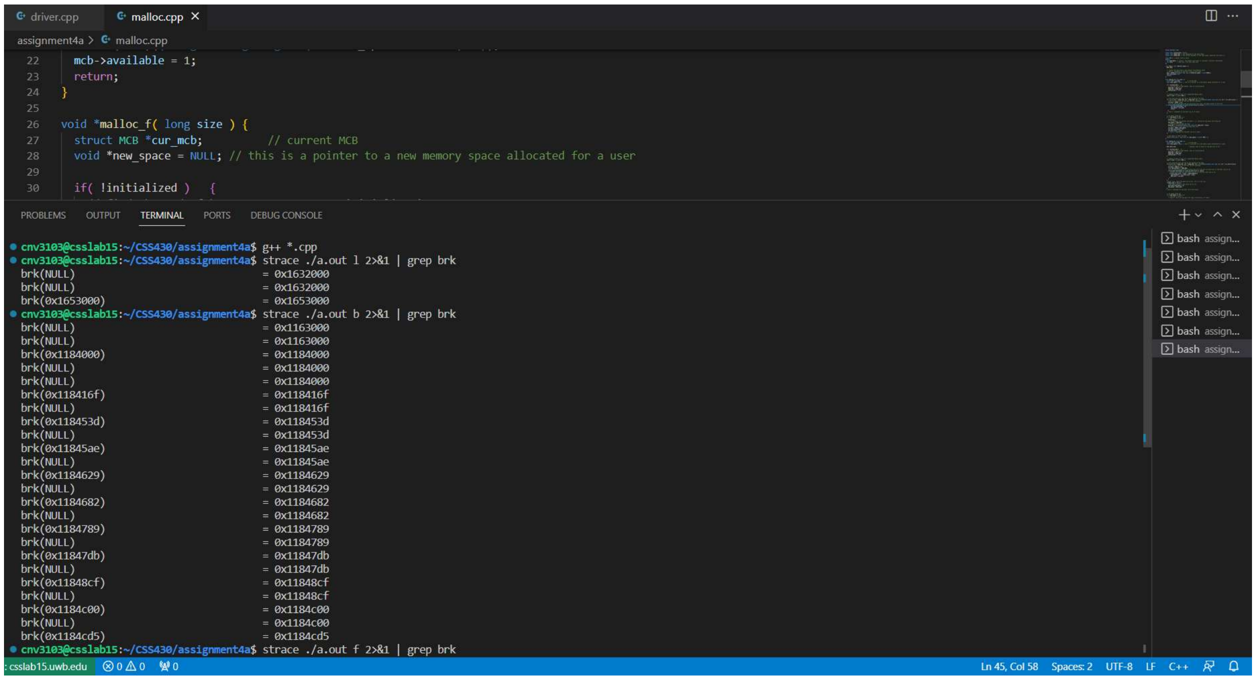
Output for $ strace ./a.out l 2>&1 | grep brk



```cpp
    mcb->available = 1;
    return;
}

void *malloc_f( long size ) {
  struct MCB *cur_mcb;          // current MCB
  void *new_space = NULL; // this is a pointer to a new memory space allocated for a user

  if( !initialized )  {
    // find the end of heap memory, upon an initialization
    heap_end = sbrk( 0 );
    heap_top = heap_end;
    initialized = true;
  }

  // append an MCB in front of a requested memroy space
  size = size + sizeof( MCB );

  // scan each mcb from the top to the bottom of the heap
  for (void *cur = heap_top; cur < heap_end; cur = (void*)((unsigned long long int) cur + cur_mcb->size)) {
    //let cur_mcb point to each mcb you are scanning
    cur_mcb = (MCB* ) cur;
    //if cur_mcb->available and cur_mcb->size fits size, new_space points to this mcb
    if(cur_mcb->available == 1 && cur_mcb->size >= size){
        cur_mcb->available = 0;
        new_space = cur_mcb;
        break;
    }
  // Task 1: implement by yourself (up to 15 lines).
  }
```

```
cnv3103@csslab15:~/CSS430/assignment4a$ g++ *.cpp
cnv3103@csslab15:~/CSS430/assignment4a$ strace ./a.out l 2>&1 | grep brk
brk(NULL)                               = 0x1632000
brk(NULL)                               = 0x1632000
brk(0x1653000)                          = 0x1653000
cnv3103@csslab15:~/CSS430/assignment4a$ strace ./a.out b 2>&1 | grep brk
```

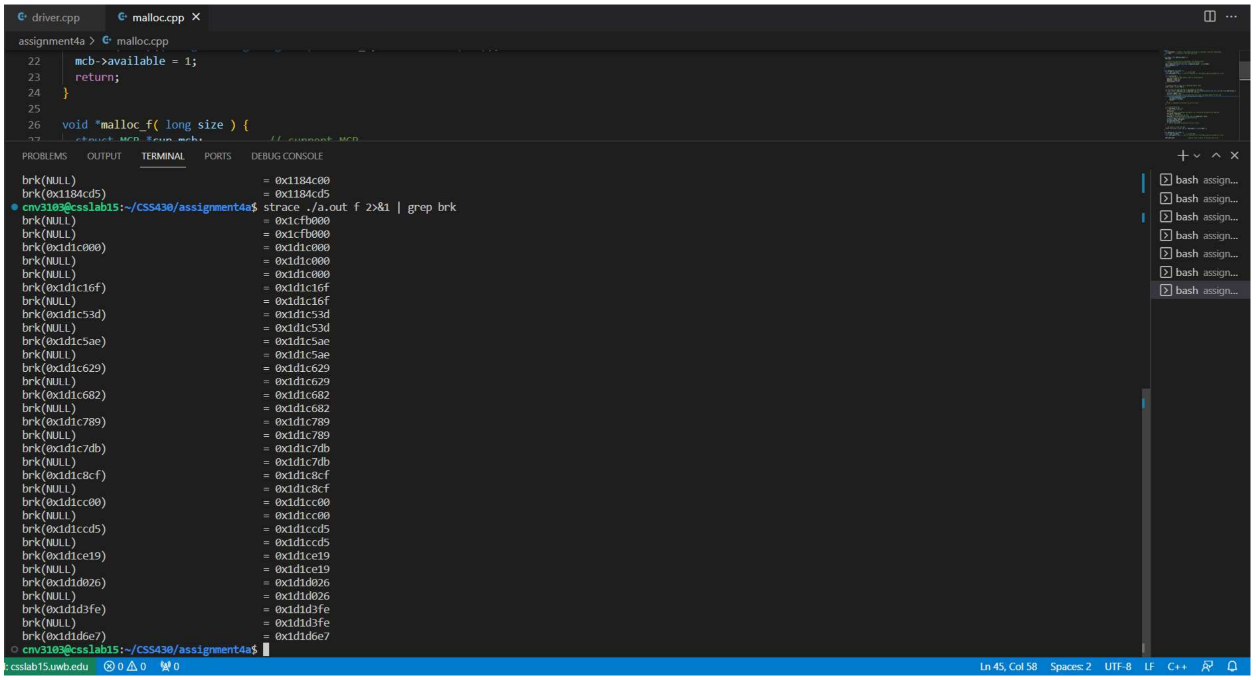
Output for $ strace ./a.out b 2>&1 | grep brk



```cpp
    mcb->available = 1;
    return;
  }

  void *malloc_f( long size ) {
    struct MCB *cur_mcb;           // current MCB
    void *new_space = NULL; // this is a pointer to a new memory space allocated for a user

    if( !initialized )  {
```

```
cnv3103@csslab15:~/CSS430/assignment4a$ g++ *.cpp
cnv3103@csslab15:~/CSS430/assignment4a$ strace ./a.out l 2>&1 | grep brk
brk(NULL)                               = 0x1632000
brk(NULL)                               = 0x1632000
brk(0x1653000)                          = 0x1653000
cnv3103@csslab15:~/CSS430/assignment4a$ strace ./a.out b 2>&1 | grep brk
brk(NULL)                               = 0x1163000
brk(NULL)                               = 0x1163000
brk(0x1184000)                          = 0x1184000
brk(NULL)                               = 0x1184000
brk(NULL)                               = 0x1184000
brk(0x118416f)                          = 0x118416f
brk(NULL)                               = 0x118416f
brk(0x118453d)                          = 0x118453d
brk(NULL)                               = 0x118453d
brk(0x11845ae)                          = 0x11845ae
brk(NULL)                               = 0x11845ae
brk(0x1184629)                          = 0x1184629
brk(NULL)                               = 0x1184629
brk(0x1184682)                          = 0x1184682
brk(NULL)                               = 0x1184682
brk(0x1184789)                          = 0x1184789
brk(NULL)                               = 0x1184789
brk(0x11847db)                          = 0x11847db
brk(NULL)                               = 0x11847db
brk(0x11848cf)                          = 0x11848cf
brk(NULL)                               = 0x11848cf
brk(0x1184c00)                          = 0x1184c00
brk(NULL)                               = 0x1184c00
brk(0x1184cd5)                          = 0x1184cd5
cnv3103@csslab15:~/CSS430/assignment4a$ strace ./a.out f 2>&1 | grep brk
```

Output for $ strace ./a.out f 2>&1 | grep brk



```cpp
    mcb->available = 1;
    return;
  }

  void *malloc_f( long size ) {
```

```
brk(NULL)                               = 0x1184c00
brk(0x1184cd5)                          = 0x1184cd5
cnv3103@csslab15:~/CSS430/assignment4a$ strace ./a.out f 2>&1 | grep brk
brk(NULL)                               = 0x1cfb000
brk(NULL)                               = 0x1cfb000
brk(0x1d1c000)                          = 0x1d1c000
brk(NULL)                               = 0x1d1c000
brk(NULL)                               = 0x1d1c000
brk(0x1d1c16f)                          = 0x1d1c16f
brk(NULL)                               = 0x1d1c16f
brk(0x1d1c53d)                          = 0x1d1c53d
brk(NULL)                               = 0x1d1c53d
brk(0x1d1c5ae)                          = 0x1d1c5ae
brk(NULL)                               = 0x1d1c5ae
brk(0x1d1c629)                          = 0x1d1c629
brk(NULL)                               = 0x1d1c629
brk(0x1d1c682)                          = 0x1d1c682
brk(NULL)                               = 0x1d1c682
brk(0x1d1c789)                          = 0x1d1c789
brk(NULL)                               = 0x1d1c789
brk(0x1d1c7db)                          = 0x1d1c7db
brk(NULL)                               = 0x1d1c7db
brk(0x1d1c8cf)                          = 0x1d1c8cf
brk(NULL)                               = 0x1d1c8cf
brk(0x1d1cc00)                          = 0x1d1cc00
brk(NULL)                               = 0x1d1cc00
brk(0x1d1ccd5)                          = 0x1d1ccd5
brk(NULL)                               = 0x1d1ccd5
brk(0x1d1ce19)                          = 0x1d1ce19
brk(NULL)                               = 0x1d1ce19
brk(0x1d1d026)                          = 0x1d1d026
brk(NULL)                               = 0x1d1d026
brk(0x1d1d3fe)                          = 0x1d1d3fe
brk(NULL)                               = 0x1d1d3fe
brk(0x1d1d6e7)                          = 0x1d1d6e7
cnv3103@csslab15:~/CSS430/assignment4a$ 
```