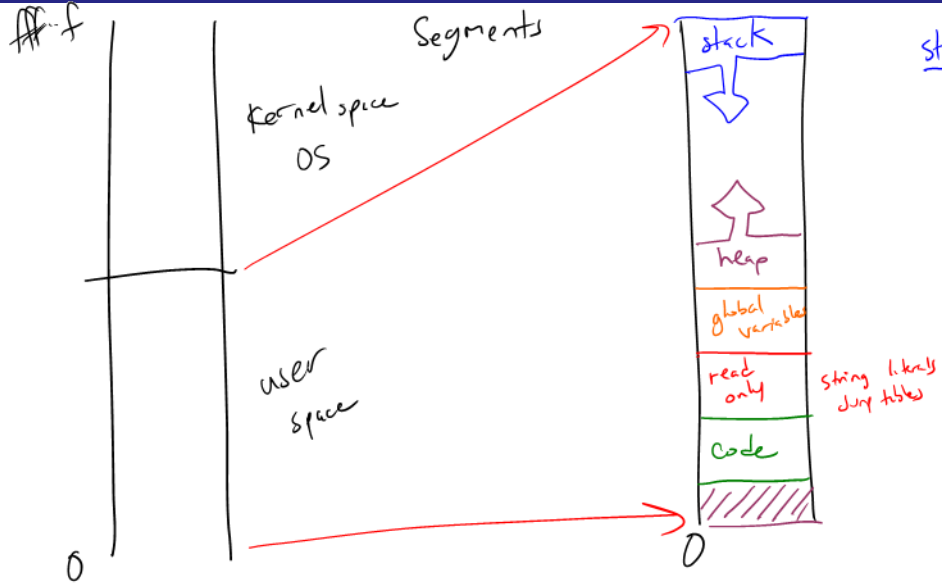
C, Memory

CS 2130: Computer Systems and Organization 1
November 12, 2025

Announcements

- Homework 8 due Monday on Gradescope

Memory

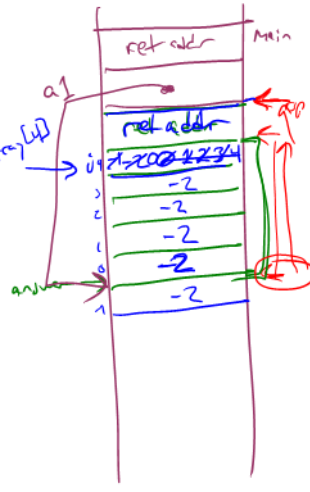

fff...f
Segments
kernel space
OS
user space
0
0
stack
heap
global variables
read only
code
String literals
stack frame
- parameters
- ret address
- local vars

An Interesting Stack Example

```
int *makeArray() {
    int answer[5];
    return answer;
}

void setTo(int *array, int length, int value) {
    for(int i=0; i<length; i+=1)
        array[i] = value;
}

int main(int argc, const char *argv[]) {
    int *a1 = makeArray();
    setTo(a1, 5, -2);
    return 0;
}
```



The Heap

The heap: unorganized memory for our data

- Most code we write will use the heap
- *Not a heap data structure...*

The Heap: Requesting Memory

```
void *malloc(size_t size);
```

- Ask for `size` bytes of memory
- Returns a `(void *)` pointer to the first byte
- It does not know what we will use the space for!
- Does not erase (or zero) the memory it returns

Java

What is the closest thing to `malloc` in Java?

`malloc` man page

`malloc` Example

```c
typedef struct student_s {
    const char *name;
    int credits;
} student;

student *enroll(const char *name, int transfer_credits) {
    student *ans = (student *)malloc(sizeof(student));
    ans->name = name;
    ans->credits = transfer_credits;
    return ans;
}
```

The Heap: Freeing Memory

Freeing memory: `free`

```
void free(void *ptr);
```

- Accepts a pointer returned by `malloc`
- Marks that memory as no longer in use, available to use later
- You should `free()` memory to avoid *memory leaks*