C Introduction

CS 2130: Computer Systems and Organization 1
October 29, 2025

Announcements

- Homework 7 **due Monday at 11:59pm** on Gradescope
- Exam 2 next Friday

Data Types in C

Pointers - how C uses addresses!

- Hold the address of a position in memory
- Need to know the kind of information stored at that location

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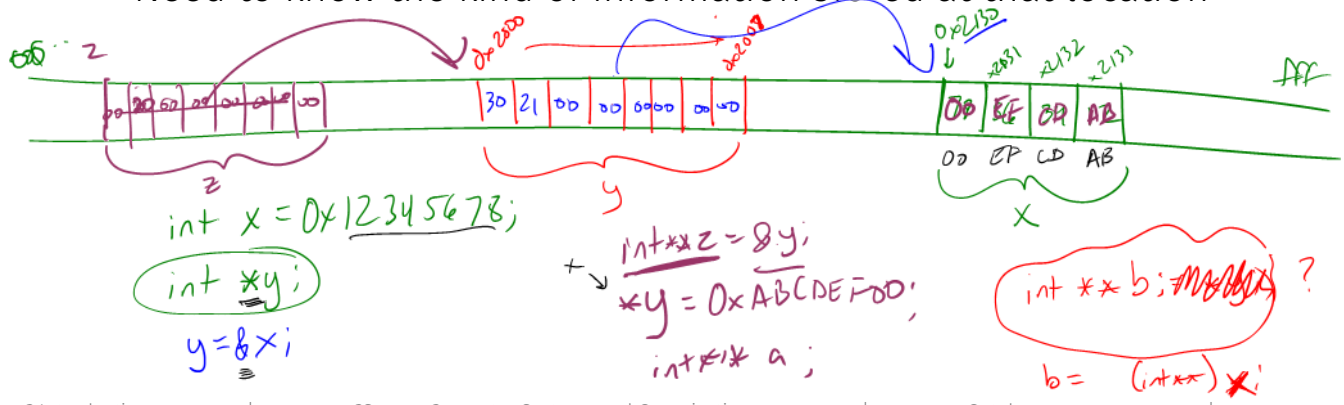

Example

```
int main() {
    int x = 3;
    long y = 4;
    int *a = &x;
    long *b = &y;
    long z = *a;
    int w = *b;
    return 0;
}
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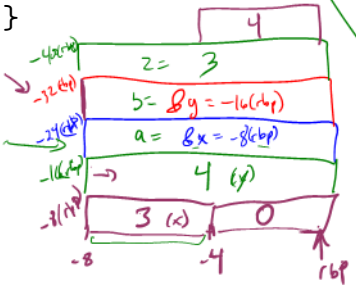
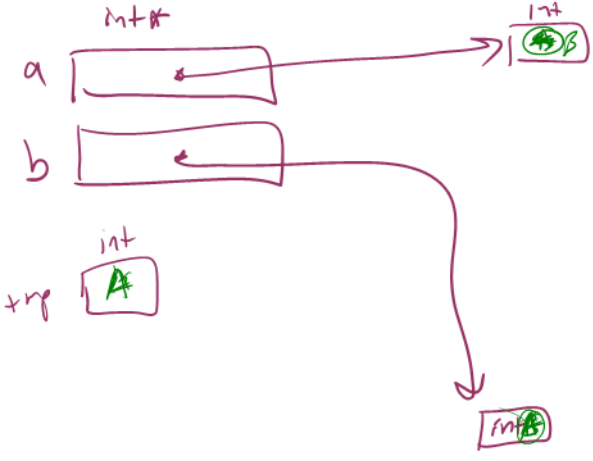



```
0000000000000000 <main>:
   0:   55                      push   %rbp
   1:   48 89 e5                mov    %rsp,%rbp
   4:   31 c0                   xor    %eax,%eax
   6:   c7 45 fc 00 00 00 00    movl   $0x0,-0x4(%rbp)
   d:   c7 45 f8 03 00 00 00    movl   $0x3,-0x8(%rbp)
  14:   48 c7 45 f0 04 00 00    movq   $0x4,-0x10(%rbp)
  1b:   00
  1c:   48 8d 4d f8             lea    -0x8(%rbp),%rcx
  20:   48 89 4d e8             mov    %rcx,-0x18(%rbp)
  24:   48 8d 4d f0             lea    -0x10(%rbp),%rcx
  28:   48 89 4d e0             mov    %rcx,-0x20(%rbp)
  2c:   48 8b 4d e8             mov    -0x18(%rbp),%rcx
  30:   48 63 09                movslq (%rcx),%rcx
  33:   48 89 4d d8             mov    %rcx,-0x28(%rbp)
  37:   48 8b 4d e0             mov    -0x20(%rbp),%rcx   &y
  3b:   48 8b 09                mov    (%rcx),%rcx        4
  3e:   89 4d d4                mov    %ecx,-0x2c(%rbp)
  41:   5d                      pop    %rbp
  42:   c3                      retq
```

Example

Swap Example

```
void swap(int *a, int *b) {
    int tmp = *a;
    *a = *b;
    *b = tmp;
}
```



Arrays

Array: 0 or more values of same type stored contiguously in memory

- Declare as you would use: `int myarr[100];`
- `sizeof(myarr)` = 400 — 100 4-byte integers
- `myarr` treated as pointer to first element
- Can declare array literals:
  `int y[5] = {1, 1, 2, 3, 5}`

Pointers and Arrays

`*myarr` and `myarr[0]` are equivalent

- Pointer to single value and pointer to first value in array
- Treat array as pointer to the first value (lowest address)
- Indexing into array: `myarr[n]` and `*(myarr+n)`
  - If `myarr` is an `int *`, then `myarr+1` points to **next int** in memory
  - Adding 1 to pointer adds `sizeof()` the type we're pointing to