Lecture 7:
Finish Memory Stuff,
Prepare for 2D
Important Memory Concepts in C: Dereferencing

• There are two operators for getting the value at a memory location: *, and []
  – This is called dereferencing
    • * = “dereference operator”

• int *p = malloc(sizeof(int)*1);
• *p = 2; /* sets memory p points to to have value 2 */
• p[0] = 2; /* sets memory p points to to have value 2 */
Important Memory Concepts in C: Arrays

• Arrays lie in contiguous memory
  – So if you know address to one element, you know address of the rest
• int *a = malloc(sizeof(int)*1);
  – a single integer
  – ... or an array of a single integer
• int *a = malloc(sizeof(int)*2);
  – an array of two integers
  – first integer is at ‘a’
  – second integer is at the address ‘a+4’
    • Tricky point here, since C/C++ will refer to it as ‘a+1’
Important Memory Concepts in C: pointer arithmetic

- `int *p = malloc(sizeof(int)*5);`
- C/C++ allows you to modify pointer with math operations
  - called pointer arithmetic
  - “does the right thing” with respect to type
    - `int *p = malloc(sizeof(int)*5);`
    - `p+1` is 4 bytes bigger than `p`!!

- Then:
  - “`p+3`” is the same as “`&(p[3])`” (ADDRESSES)
  - “`*(p+3)`” is the same as “`p[3]`” (VALUES)
Important Memory Concepts in C: Pointers to pointers

- `int **p = malloc(sizeof(int*)*5);`
- `p[0] = malloc(sizeof(int)*50);`
- `....`

```
```

```
P[0][0]
```

```
50 integers...
```
Important Memory Concepts in C: NULL pointer

- `int *p = NULL;`
- Often stored as address `0x00000000`
- Used to initialize something to a known value
  - And also indicate that it is uninitialized...
Project 2D

• You now know what you need to do Project 2D
  – But: practice writing C programs and testing yourself!!
  – Reminder: you can `printf` with a pointer

```c
#include <stdlib.h>
#include <stdio.h>

int main()
{
    /* allocates memory */
    int *ptr = malloc(2*sizeof(int));
    printf("%p\n", ptr);
}
```

```
fawcett:VIS2016 childs$ cat t.c
fawcett:VIS2016 childs$ gcc t.c
fawcett:VIS2016 childs$ ./a.out
0x100100080
```
Project 2D

• Assigned now

• Worksheet. You print it out, complete it on your own, and bring it to class.

• Due Thursday 10am in class
  – Graded in class

• No Piazza posts on this please

• Practice with C, vi, gcc, printf