Computer System Organization Recitation [Fall 2018]

CSCI-UA 201-006

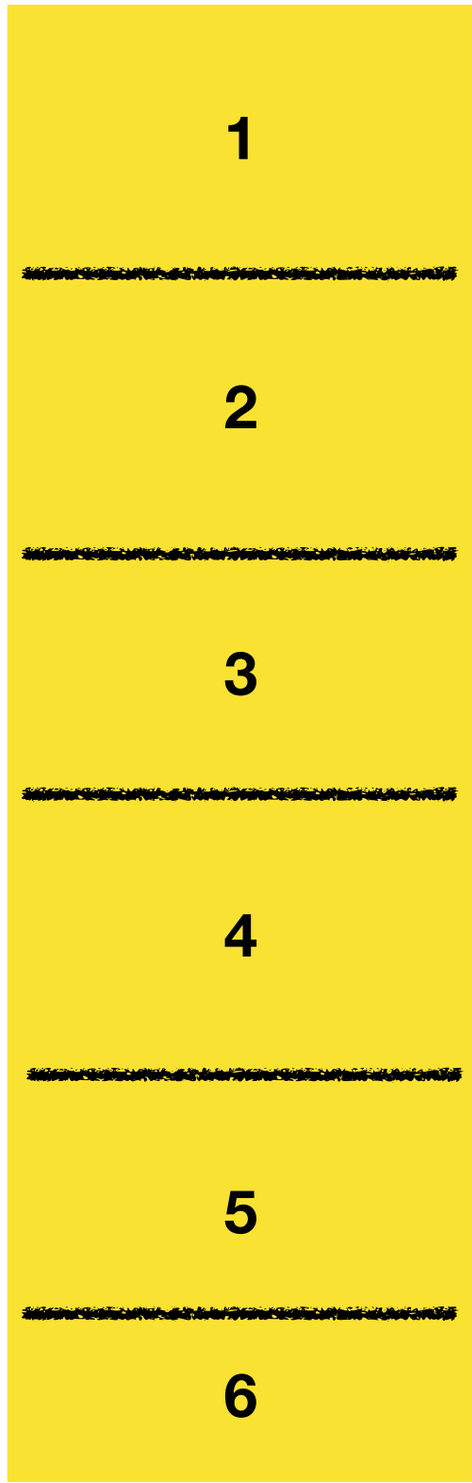
R3: pointer/array

Array access and pointer

```
int main (int argc, char ** argv) {
    int my_array[] = {1, 2, 3, 4, 5, 6};
    printf("%d", *(my_array + 4));
    printf("%d", my_array[4]);
    printf("%d", 4[my_array]);
}
```

*(my_array + 4)

*(4 + my_array)

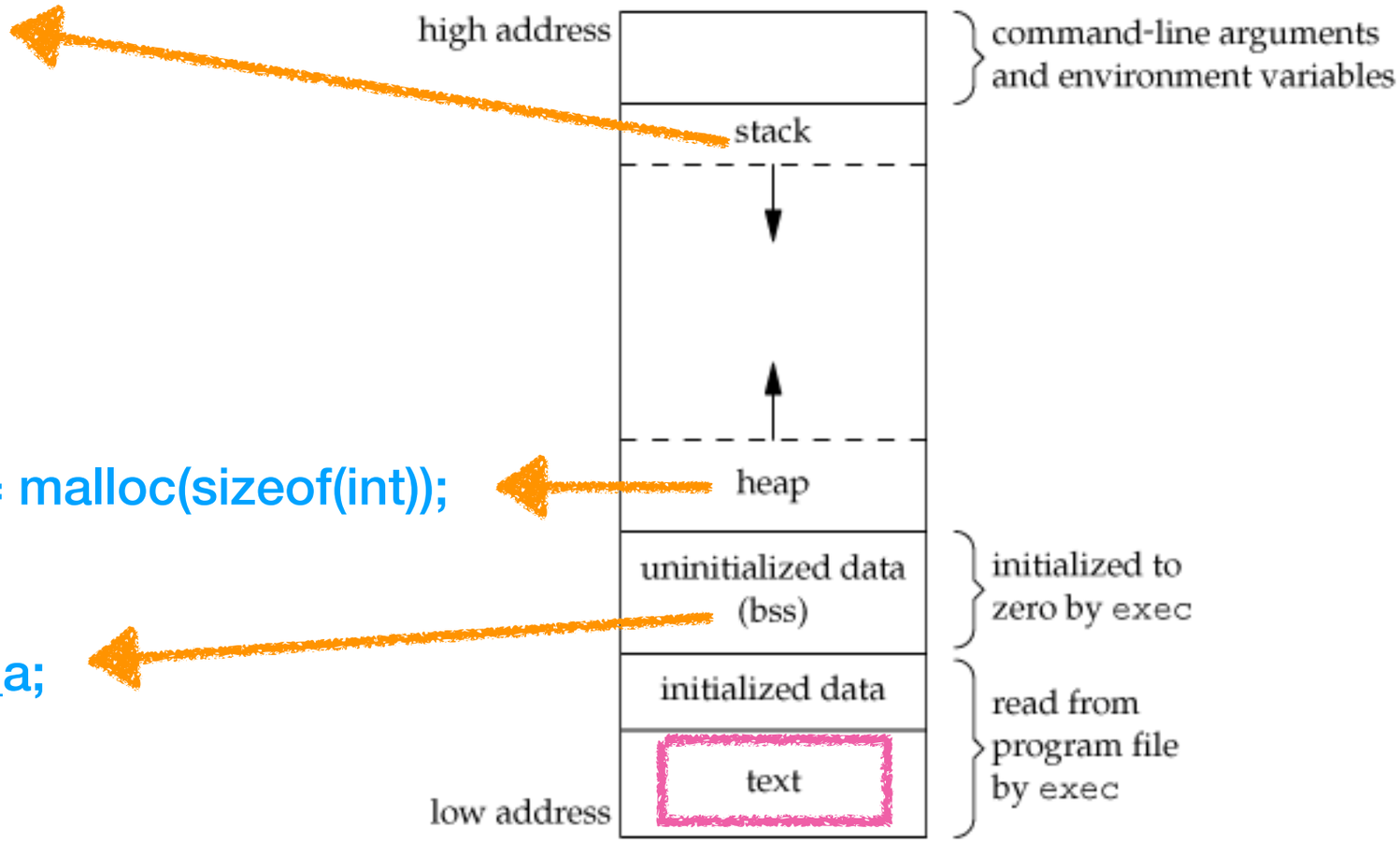


Memory layout of C programs

```
{
   int a;
}
```

```
{
   int* ptr = malloc(sizeof(int));
}
```

```
int global_a;
```

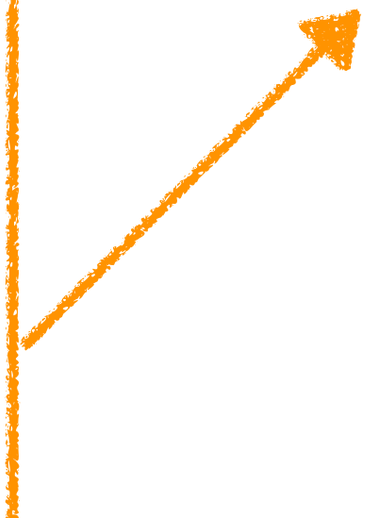


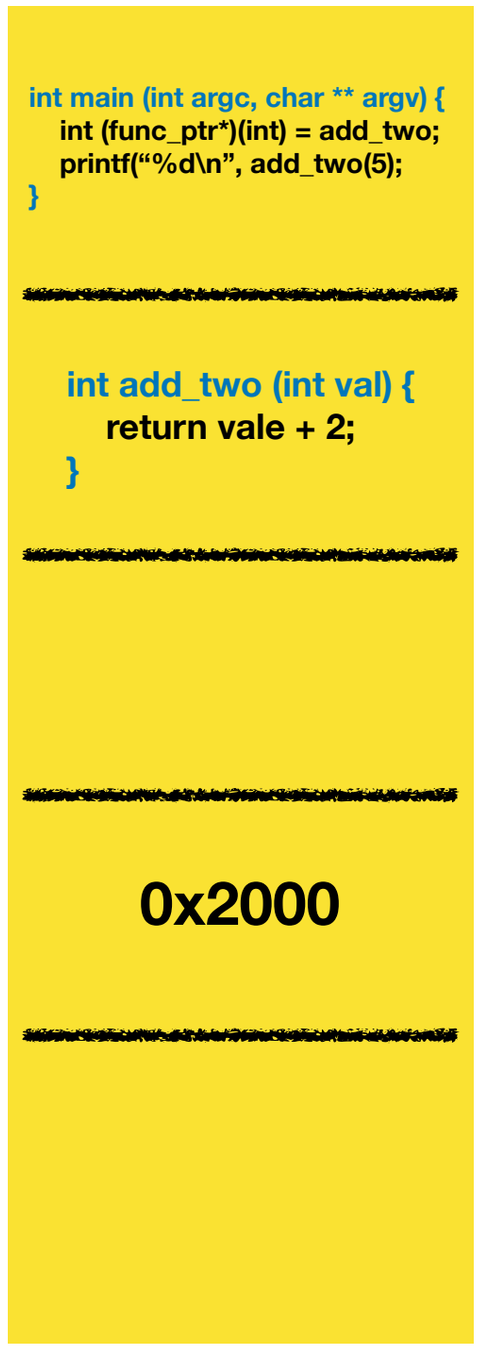
Function Pointer in C

- A function pointer is just a variable with a unique interpretation.
  - The memory address(ADDR) of that variable.
  - The number of bytes used by the variable.
  - How to interpret the content stored in ADDR.
    - It represents a memory address.
    - The content in the memory address is part of the program.

Function Pointer in C

```
int add_two (int val) {
    return vale + 2;
}

int main (int argc, char ** argv) {
    int (*func_ptr)(int) = add_two;
    printf("%d\n", func_ptr(5);
}
```





0x1000
(main)

0x2000
(add_two)

0x1000F008
(func_ptr)

0x1000F00C

Function object in C and Python

```
int add_two (int val) {
    return val + 2;
}

int main (int argc, char ** argv) {
    int (*func_ptr)(int) = add_two;
    printf(“%d\n”, add_two(5);
}
```

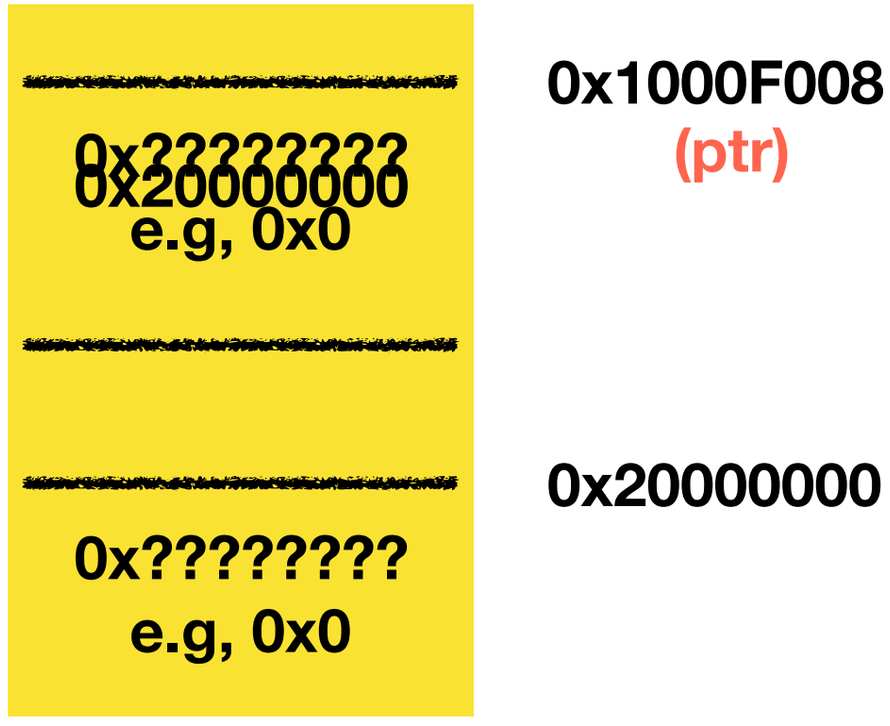
```
def add_two(val):
    return val + 2

def main():
    func_ptr = add_two
    printf(func_ptr(5))

if __name__ == ‘__main__’:
    main()
```

Segmentation Fault

- In computing, a segmentation fault(often shortened to segfault) or access violation is a fault, or failure condition, raised by hardware with memory protection, notifying an operation system the software has attempted to access a restricted area of memory(a memory access violation)
  —— Wikipedia

```
int main (int argc, char ** argv) {
    int val = 5;
    int *ptr;
    printf("%d\n", *ptr);
}
```

```
int *ptr = &val;
int *ptr = malloc(sizeof(int));
```



Core Dump

- In computing, a core dump(in Unix parlance), memory dump, or system dump consists of the recorded state of working memory of a computer program at a specific time, generally when the program has crashed or otherwise terminated abnormally.

- Let’s see how it works.
  - Type “ulimit -c unlimited” to enable core dump.

C v.s Python (loop)

```c
int main (int argc, char ** argv) {
    for (int i = 0; i < 10; i++) {
    printf("%d\n", i);
    }
}
```

```python
def main():
    for i in range(10):
        print(i)
```

C v.s Python (variable)

```c
int main (int argc, char **argv) {
    int i = 1;
    int j ;
    float k = 1.5;
}
```

```python
def main():
    i = 1
    i = 1.5
```

C v.s Python (variable)

```
int main (int argc, char **argv) {
    void* var = null;

    char* __temp1 = “12345”;
    var = (void*)__temp1;
    printf(“%s\n”, (char*) var);

    float __temp2 = 1.5;
    var = (void*) &__temp2;
    printf(“%f\n”, *((float*) var));


}
```

```
def main():
    var = “12345”
    print(var)

    var = 1.5
    print(var)
```