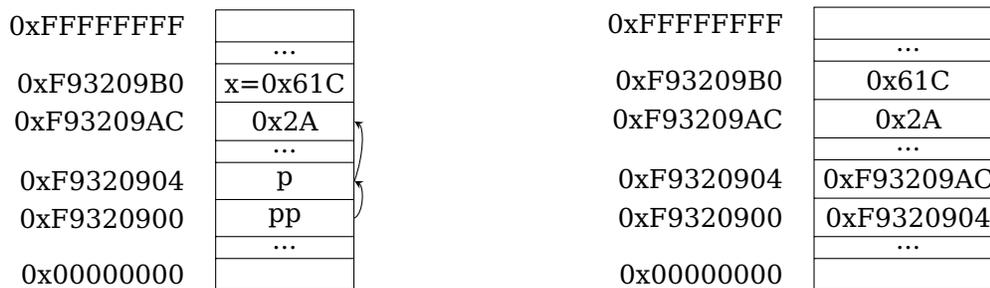


CS61C Summer 2019 Discussion 1 – C Basics

1 C Introduction

C is syntactically very similar to Java, but there are a few key differences of which to be wary:

- C is function oriented, not object oriented, so there are no objects.
- C does not automatically handle memory for you.
 - In the case of stack memory (things allocated in the “usual” way), a datum is garbage immediately after the function in which it was defined returns.
 - In the case of heap memory (things allocated with `malloc` and friends), data is freed only when the programmer explicitly frees it.
 - In any case, allocated memory always holds garbage until it is initialized.
- C uses pointers explicitly. `*p` tells us to use the value that `p` points to, rather than the value of `p`, and `&x` gives the address of `x` rather than the value of `x`. See the following example (the following addresses were chosen arbitrarily). On the left we see a diagram of pointers and memory that may help you visualize pointers. On the right, we see how those “boxes and arrows” are really represented.



Let’s assume that `int* p` is located at `0xF9320904` and `int x` is located at `0xF93209B0`. As we can observe:

- `*p` should return `0x2A` (42_{10}).
- `p` should return `0xF93209AC`.
- `x` should return `0x61C`.
- `&x` should return `0xF93209B0`.

Let’s say we have an `int **pp` that is located at `0xF9320900`. What would `pp` return? How about `*pp`? What about `**pp`?

There are other differences in C of which you should be aware of, but this should be enough for you to get your feet wet.

2 Uncommented Code? Yuck!

The following functions work correctly (note: this does not mean intelligently), but have no comments. Document the code to prevent it from causing further confusion.

1. **/* Returns the sum of the first N elements in ARR. */**

```
int foo(int *arr, size_t n) {
    return n ? arr[0] + foo(arr + 1, n - 1) : 0;
    /* Reminder syntax for ternary is: cond? true_result: false_result. */
}
```
2. **/* Returns -1 times the number of zeroes in the first N elements of ARR. */**

```
int bar(int *arr, size_t n) {
    int sum = 0, i;

    for (i = n; i > 0; i--) {
        sum += !arr[i - 1];
        /* Assume ! of a true value is 0 and ! of a false value is 1. */
    }

    return ~sum + 1;
}
```
3. **/* Does nothing. */**

```
void baz(int x, int y) {
    x = x ^ y;
    y = x ^ y;
    x = x ^ y;
}
```

3 Programming with Pointers

Implement the following functions so that they perform as described in the comments.

1. **/* Swaps the value of two ints outside of this function. */**

```
void swap(int *x, int *y) {
    int temp = *x;
    *x = *y;
    *y = temp;
}
```
2. **/* Increments the value of an int outside of this function by one. */**

```
void plus_plus(int *x) {\
    (*x)++; // or: x[0]++;
}
```
3. **/* Returns the number of bytes in a string. Does not use strlen. */**

```

int mystrlen(char* str) {
    int count = 0;
    while(*str++) {
        count++;
    }
    return count;
}

```

4 Problem?

The following code segments may contain logic and syntax errors. Find and correct them.

- ```

1. /* Returns the sum of all the elements in SUMMANDS. */
 /* When iterating through a pointer in C it is
 * necessary to pass a size alongside the pointer. */
 int sum(int* summands) { // int sum(int* summands, unsigned int n) {
 int sum = 0;
 for (int i = 0; i < sizeof(summands); i++) // for (int i = 0; i < n; i++)
 sum += *(summands + i);
 return sum;
 }

```
- ```

2. /* Increments all the letters in the string STRING, held in an array of length N.
   * Does not modify any other memory which has been previously allocated. */
   /* The ends of strings are denoted by the null terminator.
   * Simply having space for n characters in the array does not
   * mean the array is of length n.*/
   void increment(char* string, int n) {
       for (int i = 0; i < n; i++) // for (i = 0; string[i] != 0; i++)
           *(string + i)++; // string[i]++; or (*(string + i))++;
   }

   /* Consider the corner case of incrementing 0xFF.
   * Adding 1 to 0xFF will overflow back to 0, producing
   * a null terminator and shortening the string. */

```
- ```

3. /* Copies the string SRC to DST. */
 void copy(char* src, char* dst) {
 while (*dst++ = *src++);
 }
 // This code has no errors.

```
- ```

4. /* Overwrites an inputted string with "61C is awesome!" if there's room.
   * Does nothing if there is not. Assume that srcLength correctly represents
   * the length of src. */
   void CS61C(char* src, size_t srcLength) {

```

```
char *srcptr, replaceptr; // char *srcptr, *replaceptr;
char replacement[16] = "61C is awesome!";
srcptr = src;
replaceptr = replacement;
if (srcLength >= 16) {
    for (int i = 0; i < 16; i++)
        *srcptr++ = *replaceptr++;
}
}
// "char *srcptr, replaceptr" initializes a char pointer and a char.
// Not two char pointers.
// "char *srcptr, replaceptr" is not the same as "char *srcptr, *replaceptr".
```