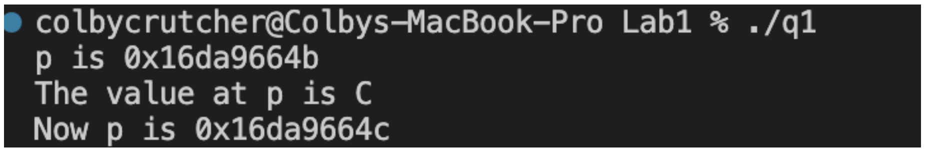
Colby Crutcher

Lab 1

Secure Coding

Question 1

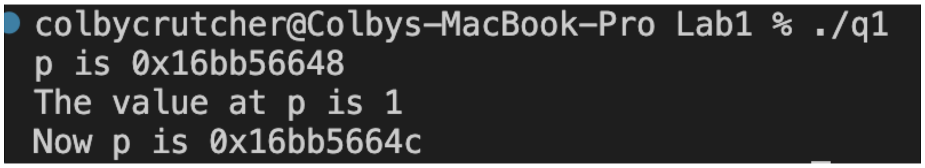
a. (3 points) Execute the program and explain the output.



```
colbycrutcher@Colbys-MacBook-Pro Lab1 % ./q1
p is 0x16da9664b
The value at p is C
Now p is 0x16da9664c
```

- The first line points p to the address of c, and prints out that value. So it prints "p is 0x16da9664b" which is the memory location address.
- The second print value states "The value of p is C". This points *p to c, and returns the character 'C'.
- The third print says "Now p is 0x16da9664c". Prior to this print statement, p = p + 1 was used and P is a memory address, it sends the new address in memory.

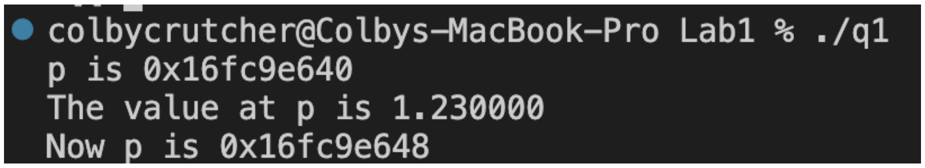
b. (3 points) Modify the code to perform the same pointer arithmetic on a pointer to an int. Execute the program and explain the output.



```
colbycrutcher@Colbys-MacBook-Pro Lab1 % ./q1
p is 0x16bb56648
The value at p is 1
Now p is 0x16bb5664c
```

- The output is essentially the same. I had to change the char in the f-string to accept an integer, as well as making defined c and *p as ints. The first line is the address in memory for p, the second just shows the value is an integer, and the address changes when we change the pointer address to + 1.

c. (3 points) Modify the code again to perform the same pointer arithmetic on a pointer to a double. Execute the program and explain the output.

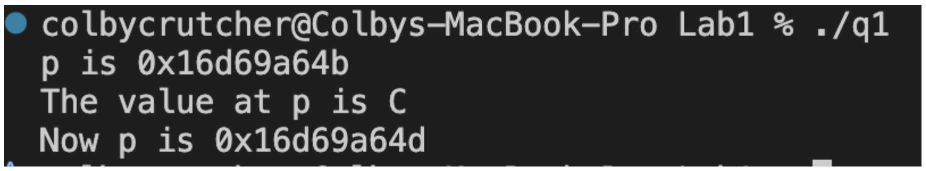


```
colbycrutcher@Colbys-MacBook-Pro Lab1 % ./q1
p is 0x16fc9e640
The value at p is 1.230000
Now p is 0x16fc9e648
```

This modification changes the output to accept a double/floating point value (allow decimal values). The same output occurs, it prints the address, then the double, then adds 1 to the address's value, ultimately changing the address where p is stored.

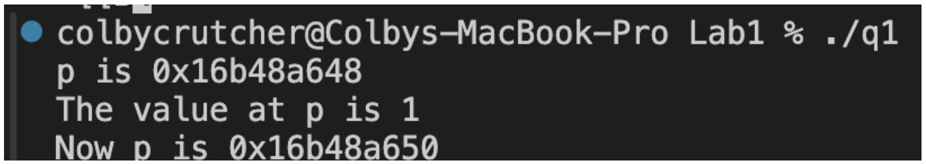
d. (6 points) What should happen if the line p = p + 1 is changed to p = p + 2 in parts a-c above? Execute the program with this change (for all of parts a-c) to verify your answer.

- a. This changes the address value from 0x16d69a64b to 0x16d69a64d.The 'b' at the end of the address value changed to a 'd'.



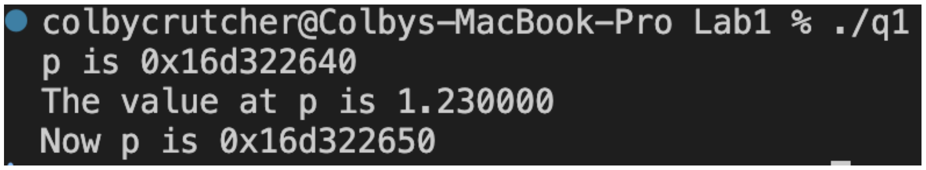
```
colbycrutcher@Colbys-MacBook-Pro Lab1 % ./q1
p is 0x16d69a64b
The value at p is C
Now p is 0x16d69a64d
```

- b. This changes the address from 0x16b48a648 to 0x16b48a650, a change of 2.



```
colbycrutcher@Colbys-MacBook-Pro Lab1 % ./q1
p is 0x16b48a648
The value at p is 1
Now p is 0x16b48a650
```

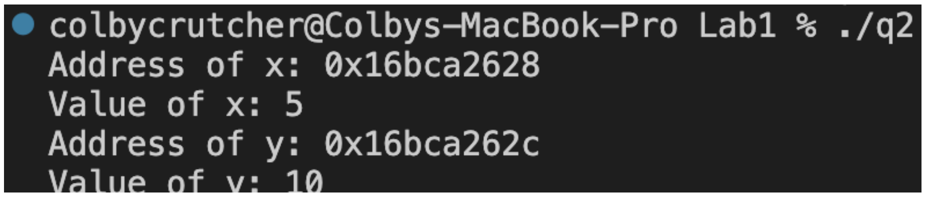
- c. This changes the address from 0x16d322640 to 0x16d322650, essentially just a change of +10 to the address value.



```
colbycrutcher@Colbys-MacBook-Pro Lab1 % ./q1
p is 0x16d322640
The value at p is 1.230000
Now p is 0x16d322650
```

Question 2

- (5 points) In the following program, add required lines of code to print the value and address of variable x in fun1, and variable y in fun2. Execute the program and precisely explain the output

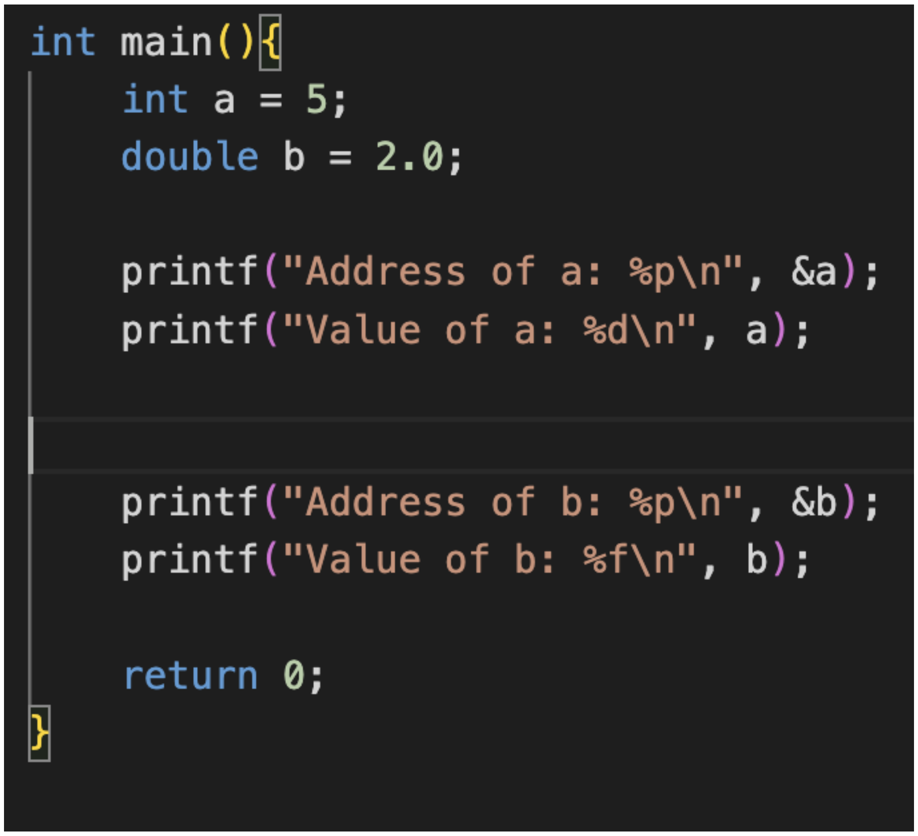


```
colbycrutcher@Colbys-MacBook-Pro Lab1 % ./q2
Address of x: 0x16bca2628
Value of x: 5
Address of y: 0x16bca262c
Value of y: 10
```

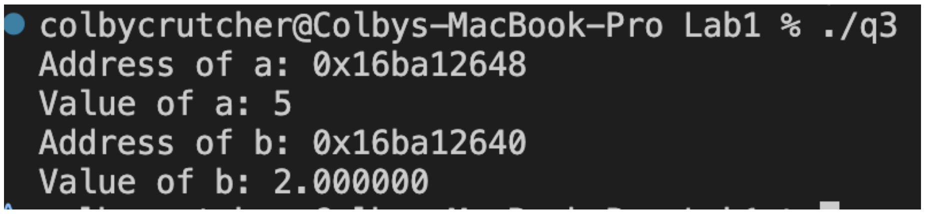
- fun1 takes in an int, and in main it is the value 5. From there I print the address, and then the value of x, which indeed is 5.
- fun2 doesn't take in any parameters, but declares the variable y as 10. I then print the address of y using %p, and feed it &y (which means address of y). After that I just print the int value of y.

Question 3

- (5 points) Write a program that declares and initializes (to any value) a double and an int. Your program should then print the address and the value stored in each of the variables, along with the amount of memory each variable occupies.



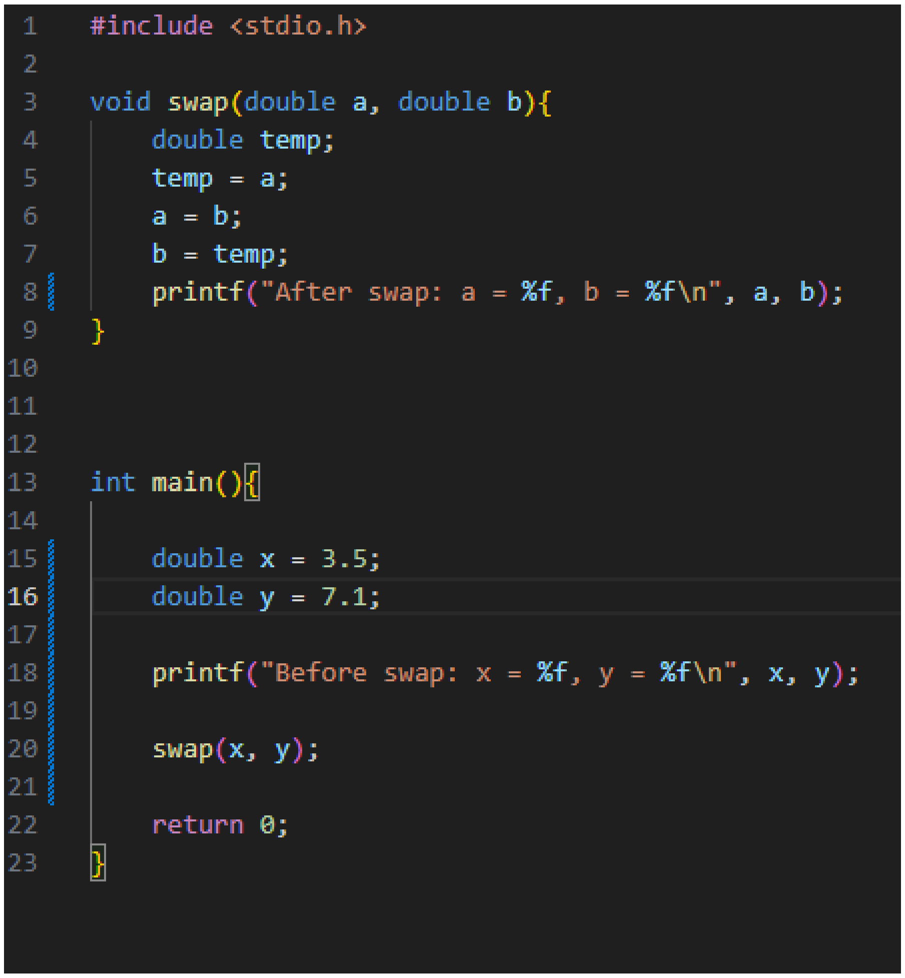
```c
int main(){
    int a = 5;
    double b = 2.0;

    printf("Address of a: %p\n", &a);
    printf("Value of a: %d\n", a);


    printf("Address of b: %p\n", &b);
    printf("Value of b: %f\n", b);

    return 0;
}
```



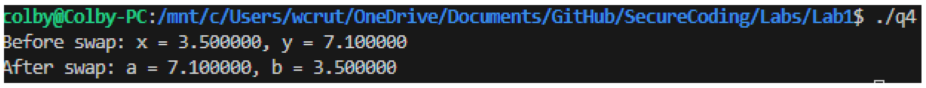
```
colbycrutcher@Colbys-MacBook-Pro Lab1 % ./q3
Address of a: 0x16ba12648
Value of a: 5
Address of b: 0x16ba12640
Value of b: 2.000000
```

Question 4

- (5 points) Write a function that accepts two double variables as parameters (by value) and swaps their values. Then call the function in the main function to verify that your function works correctly.



```c
#include <stdio.h>

void swap(double a, double b){
    double temp;
    temp = a;
    a = b;
    b = temp;
    printf("After swap: a = %f, b = %f\n", a, b);
}



int main(){

    double x = 3.5;
    double y = 7.1;

    printf("Before swap: x = %f, y = %f\n", x, y);

    swap(x, y);

    return 0;
}
```



```
colby@Colby-PC:/mnt/c/Users/wcrut/OneDrive/Documents/GitHub/SecureCoding/Labs/Lab1$ ./q4
Before swap: x = 3.500000, y = 7.100000
After swap: a = 7.100000, b = 3.500000
```

Figure 1: Output