CS 2263 - FR01A

Lab 3

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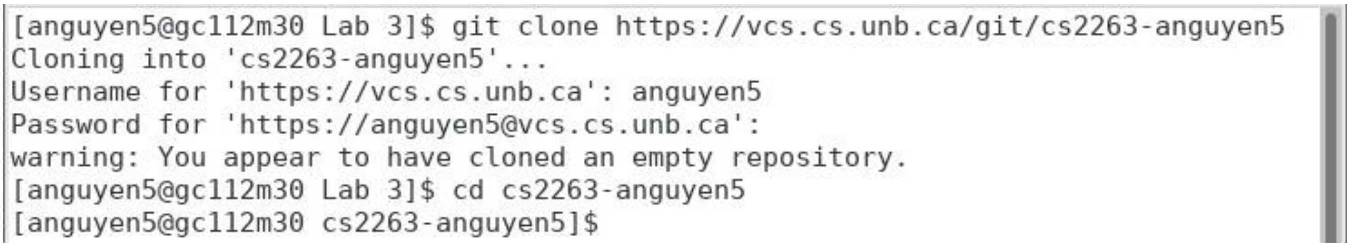
Exercise Zero:

Choose a location in your home directory on the lab machine to hold your CS2263 source code. Clone your existing (and empty) repo from the FCS git server using the command

```
$ git clone https://vcs.cs.unb.ca/git/cs2263-<yourId>
```

Now move into the local area

```
$ cd cs2263-<yourId>
```

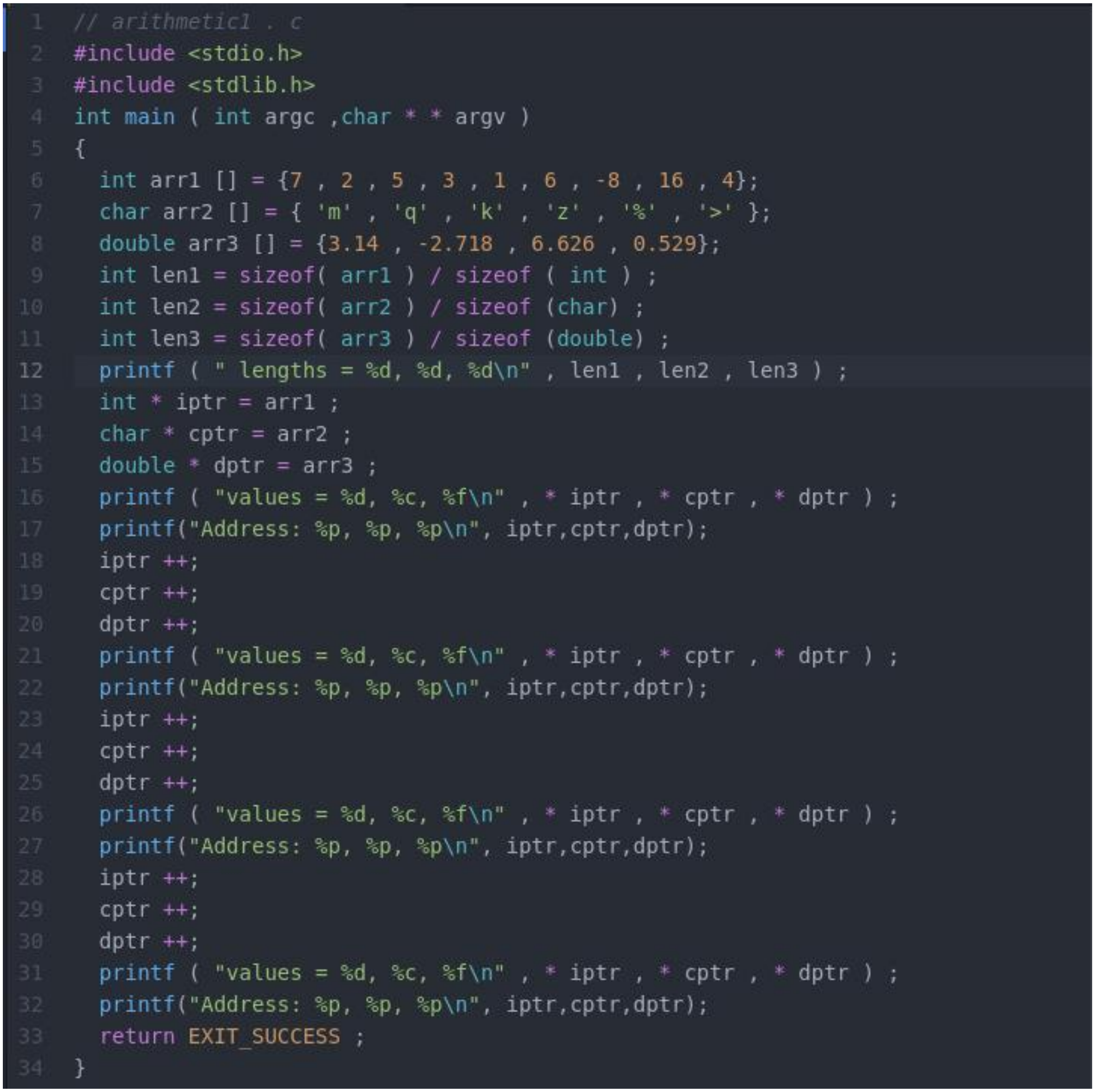


```
[anguyen5@gc112m30 Lab 3]$ git clone https://vcs.cs.unb.ca/git/cs2263-anguyen5
Cloning into 'cs2263-anguyen5'...
Username for 'https://vcs.cs.unb.ca': anguyen5
Password for 'https://anguyen5@vcs.cs.unb.ca':
warning: You appear to have cloned an empty repository.
[anguyen5@gc112m30 Lab 3]$ cd cs2263-anguyen5
[anguyen5@gc112m30 cs2263-anguyen5]$
```

Figure 1: A screenshot of cloning and moving into the local area

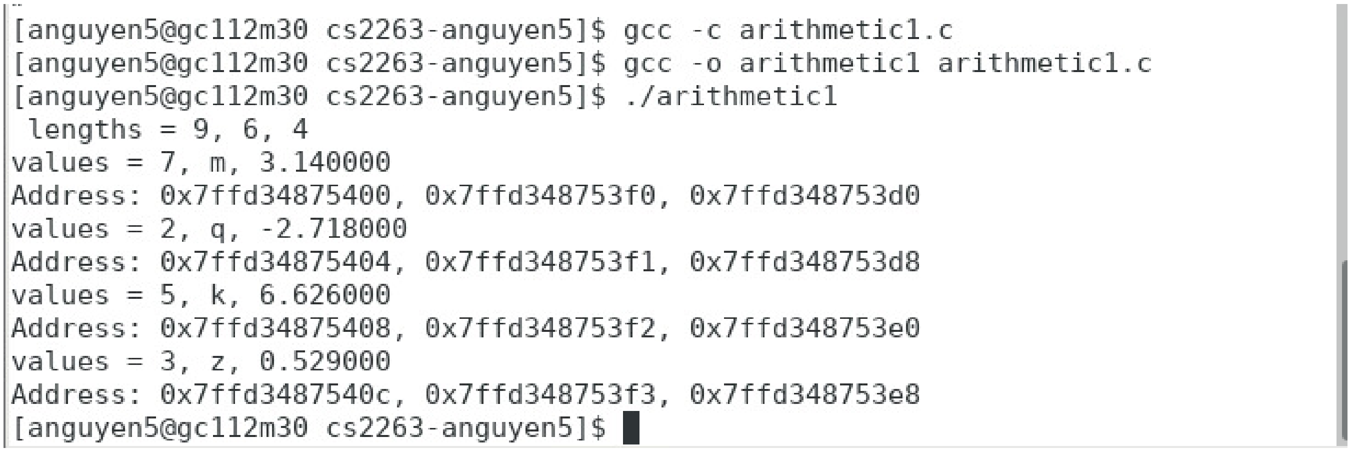
Exercise One:

Modify and run the arithmetic1.c program from the textbook, page 55, by adding the printing, in the hex notation using the %p format, of the memory addresses stored in the variables iptr**, `cptr`, and `dptr`.**



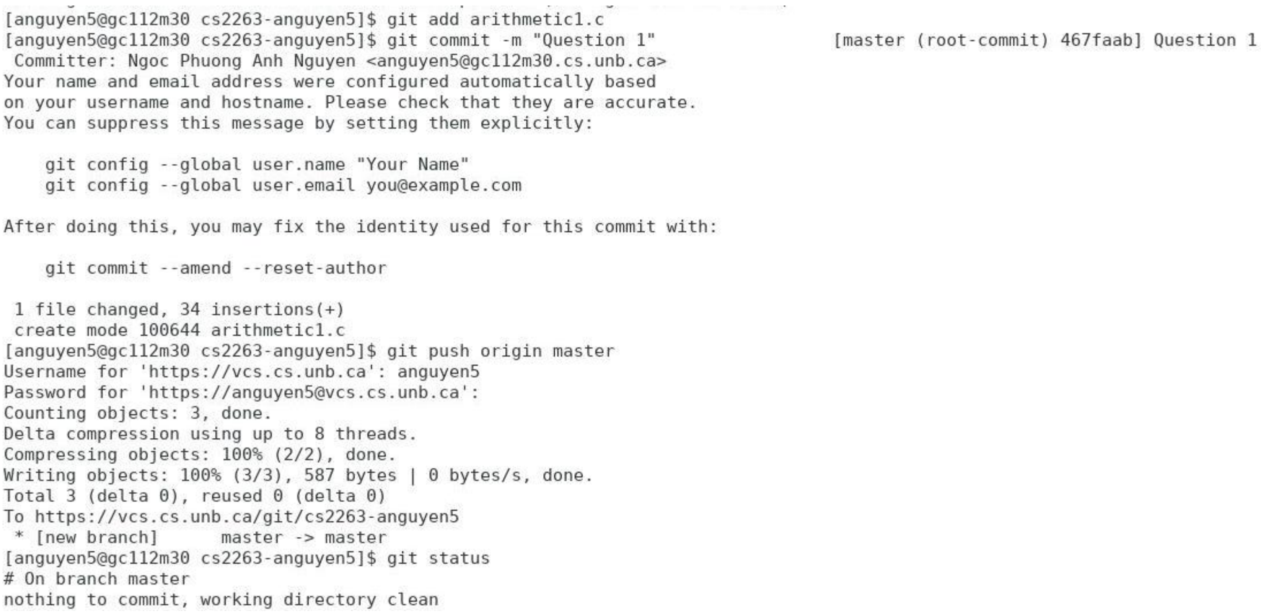
```
// arithmetic1 . c
#include <stdio.h>
#include <stdlib.h>
int main ( int argc ,char * * argv )
{
  int arr1 [] = {7 , 2 , 5 , 3 , 1 , 6 , -8 , 16 , 4};
  char arr2 [] = { 'm' , 'q' , 'k' , 'z' , '%' , '>' };
  double arr3 [] = {3.14 , -2.718 , 6.626 , 0.529};
  int len1 = sizeof( arr1 ) / sizeof ( int ) ;
  int len2 = sizeof( arr2 ) / sizeof (char) ;
  int len3 = sizeof( arr3 ) / sizeof (double) ;
  printf ( " lengths = %d, %d, %d\n" , len1 , len2 , len3 ) ;
  int * iptr = arr1 ;
  char * cptr = arr2 ;
  double * dptr = arr3 ;
  printf ( "values = %d, %c, %f\n" , * iptr , * cptr , * dptr ) ;
  printf("Address: %p, %p, %p\n", iptr,cptr,dptr);
  iptr ++;
  cptr ++;
  dptr ++;
  printf ( "values = %d, %c, %f\n" , * iptr , * cptr , * dptr ) ;
  printf("Address: %p, %p, %p\n", iptr,cptr,dptr);
  iptr ++;
  cptr ++;
  dptr ++;
  printf ( "values = %d, %c, %f\n" , * iptr , * cptr , * dptr ) ;
  printf("Address: %p, %p, %p\n", iptr,cptr,dptr);
  iptr ++;
  cptr ++;
  dptr ++;
  printf ( "values = %d, %c, %f\n" , * iptr , * cptr , * dptr ) ;
  printf("Address: %p, %p, %p\n", iptr,cptr,dptr);
  return EXIT_SUCCESS ;
}
```

Figure 2: The modified source code



```
[anguyen5@gc112m30 cs2263-anguyen5]$ gcc -c arithmetic1.c
[anguyen5@gc112m30 cs2263-anguyen5]$ gcc -o arithmetic1 arithmetic1.c
[anguyen5@gc112m30 cs2263-anguyen5]$ ./arithmetic1
 lengths = 9, 6, 4
values = 7, m, 3.140000
Address: 0x7ffd34875400, 0x7ffd348753f0, 0x7ffd348753d0
values = 2, q, -2.718000
Address: 0x7ffd34875404, 0x7ffd348753f1, 0x7ffd348753d8
values = 5, k, 6.626000
Address: 0x7ffd34875408, 0x7ffd348753f2, 0x7ffd348753e0
values = 3, z, 0.529000
Address: 0x7ffd3487540c, 0x7ffd348753f3, 0x7ffd348753e8
[anguyen5@gc112m30 cs2263-anguyen5]$ 
```

Figure 3: The screenshot of the output from the program



```
[anguyen5@gc112m30 cs2263-anguyen5]$ git add arithmetic1.c
[anguyen5@gc112m30 cs2263-anguyen5]$ git commit -m "Question 1"             [master (root-commit) 467faab] Question 1
 Committer: Ngoc Phuong Anh Nguyen <anguyen5@gc112m30.cs.unb.ca>
Your name and email address were configured automatically based
on your username and hostname. Please check that they are accurate.
You can suppress this message by setting them explicitly:

    git config --global user.name "Your Name"
    git config --global user.email you@example.com

After doing this, you may fix the identity used for this commit with:

    git commit --amend --reset-author

 1 file changed, 34 insertions(+)
 create mode 100644 arithmetic1.c
[anguyen5@gc112m30 cs2263-anguyen5]$ git push origin master
Username for 'https://vcs.cs.unb.ca': anguyen5
Password for 'https://anguyen5@vcs.cs.unb.ca':
Counting objects: 3, done.
Delta compression using up to 8 threads.
Compressing objects: 100% (2/2), done.
Writing objects: 100% (3/3), 587 bytes | 0 bytes/s, done.
Total 3 (delta 0), reused 0 (delta 0)
To https://vcs.cs.unb.ca/git/cs2263-anguyen5
 * [new branch]      master -> master
[anguyen5@gc112m30 cs2263-anguyen5]$ git status
# On branch master
nothing to commit, working directory clean
```

Figure 4: The screenshot of you pushing the program source to the FCS git

QUESTIONS:

Are the pointer variables incremented correctly? Show your calculations based on the memory addresses printed by your program.

The pointer variables are incremented correctly.

The first pointer pointed to an integer array including 4 byte – elements.

- The address of the first element = 0x7ffd34875400
- The address of the second element = The address of the first element + 4 = 0x7ffd34875400 + 4 = 0x7ffd34875404
- The address of the third element = The address of the second element + 4 = 0x7ffd34875404 + 4 = 0x7ffd34875408

- The address of the fourth element = The address of the third element + 4 = 0x7ffd34875408 + 4 = 0x7ffd3487540c

The second pointer pointed to a char array including 1 byte – elements.

- The address of the first element = 0x7ffd348753f0
- The address of the second element = The address of the first element + 1 = 0x7ffd348753f0 + 1 = 0x7ffd348753f1
- The address of the third element = The address of the second element + 1 = 0x7ffd348753f1 + 1 = 0x7ffd348753f2
- The address of the fourth element = The address of the third element + 1 = 0x7ffd348753f2 + 1 = 0x7ffd348753f3

The third pointer pointed to a double array including 8 byte – elements.

- The address of the first element = 0x7ffd348753d0
- The address of the second element = The address of the first element + 8 = 0x7ffd348753d0+ 8 = 0x7ffd348753d8
- The address of the third element = The address of the second element + 8 = 0x7ffd348753d8+ 8 = 0x7ffd348753e0
- The address of the fourth element = The address of the third element + 8 = 0x7ffd348753e0+ 8 = 0x7ffd348753e8

Are the increments for different pointers the same? Explain why.

The increments for different pointers are not the same, because each of them points to different variables, which also have different data types.

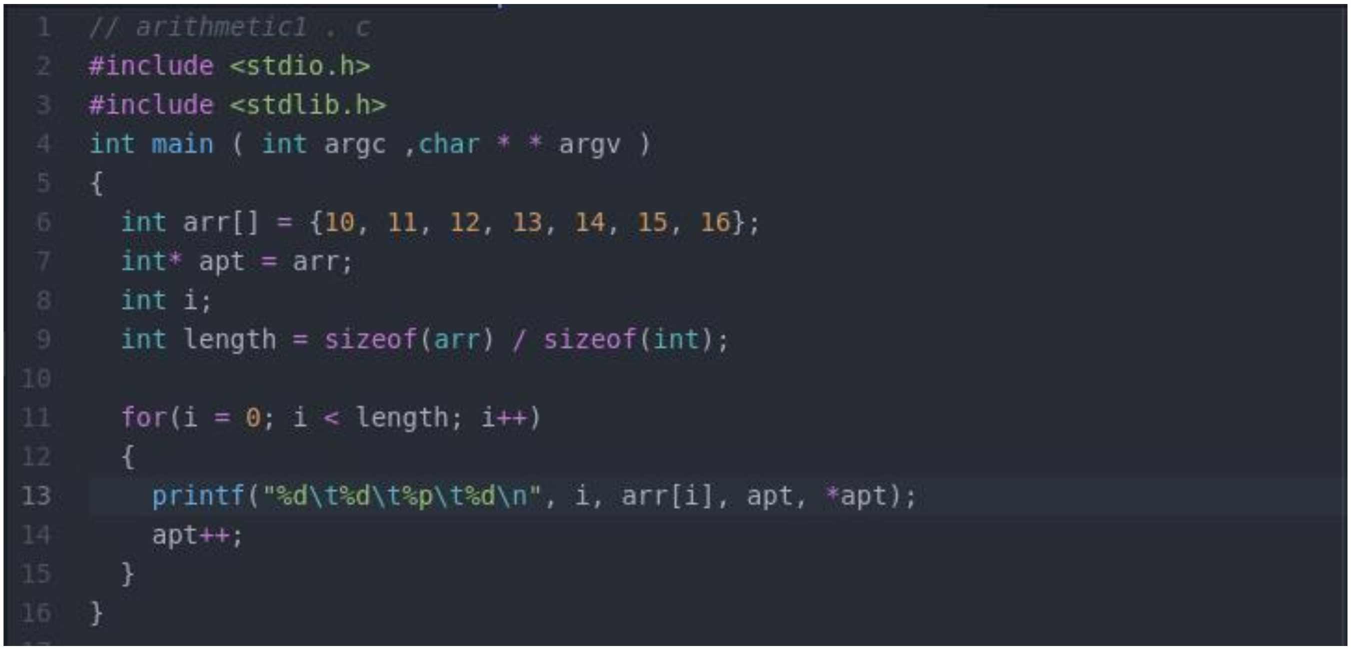
Exercise Two:

Write and test a C program uses the C function that prints every element of the array of integers twice: first by referencing the value of each array element with the integer index and then by referencing the same value in the array with the pointer (which is then incremented to get to the next value). On each line of output include: the array element index, the array element value, the array element memory address and then the array element value again. Test your program on

```
int arr[] = {10, 11, 12, 13, 14, 15, 16}
```

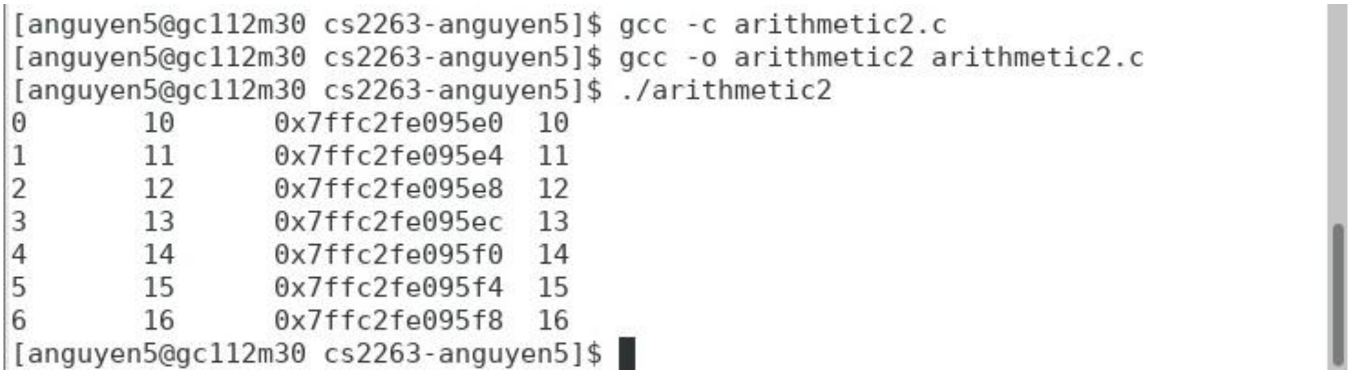
The first line of output should resemble:

```
0    10   0xffffffffffff1234  10
```



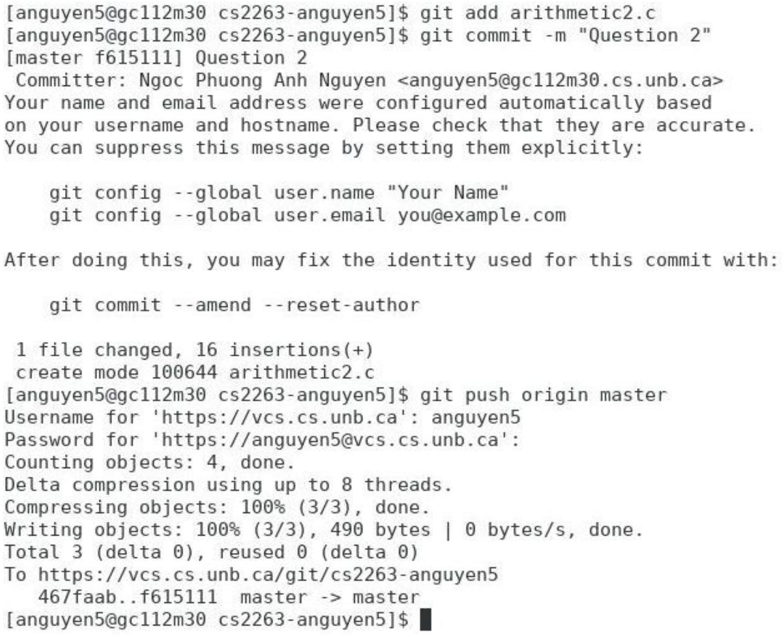
```c
// arithmetic1 . c
#include <stdio.h>
#include <stdlib.h>
int main ( int argc ,char * * argv )
{
  int arr[] = {10, 11, 12, 13, 14, 15, 16};
  int* apt = arr;
  int i;
  int length = sizeof(arr) / sizeof(int);

  for(i = 0; i < length; i++)
  {
    printf("%d\t%d\t%p\t%d\n", i, arr[i], apt, *apt);
    apt++;
  }
}
```

Figure 5: The modified source code



```
[anguyen5@gc112m30 cs2263-anguyen5]$ gcc -c arithmetic2.c
[anguyen5@gc112m30 cs2263-anguyen5]$ gcc -o arithmetic2 arithmetic2.c
[anguyen5@gc112m30 cs2263-anguyen5]$ ./arithmetic2
0       10      0x7ffc2fe095e0  10
1       11      0x7ffc2fe095e4  11
2       12      0x7ffc2fe095e8  12
3       13      0x7ffc2fe095ec  13
4       14      0x7ffc2fe095f0  14
5       15      0x7ffc2fe095f4  15
6       16      0x7ffc2fe095f8  16
[anguyen5@gc112m30 cs2263-anguyen5]$ 
```

Figure 6: The screenshot of the output from your program



```
[anguyen5@gc112m30 cs2263-anguyen5]$ git add arithmetic2.c
[anguyen5@gc112m30 cs2263-anguyen5]$ git commit -m "Question 2"
[master f615111] Question 2
 Committer: Ngoc Phuong Anh Nguyen <anguyen5@gc112m30.cs.unb.ca>
Your name and email address were configured automatically based
on your username and hostname. Please check that they are accurate.
You can suppress this message by setting them explicitly:

    git config --global user.name "Your Name"
    git config --global user.email you@example.com

After doing this, you may fix the identity used for this commit with:

    git commit --amend --reset-author

 1 file changed, 16 insertions(+)
 create mode 100644 arithmetic2.c
[anguyen5@gc112m30 cs2263-anguyen5]$ git push origin master
Username for 'https://vcs.cs.unb.ca': anguyen5
Password for 'https://anguyen5@vcs.cs.unb.ca':
Counting objects: 4, done.
Delta compression using up to 8 threads.
Compressing objects: 100% (3/3), done.
Writing objects: 100% (3/3), 490 bytes | 0 bytes/s, done.
Total 3 (delta 0), reused 0 (delta 0)
To https://vcs.cs.unb.ca/git/cs2263-anguyen5
   467faab..f615111  master -> master
[anguyen5@gc112m30 cs2263-anguyen5]$ █
```

Figure 7: The screenshot of you pushing the program source to the FCS git

Exercise Three:

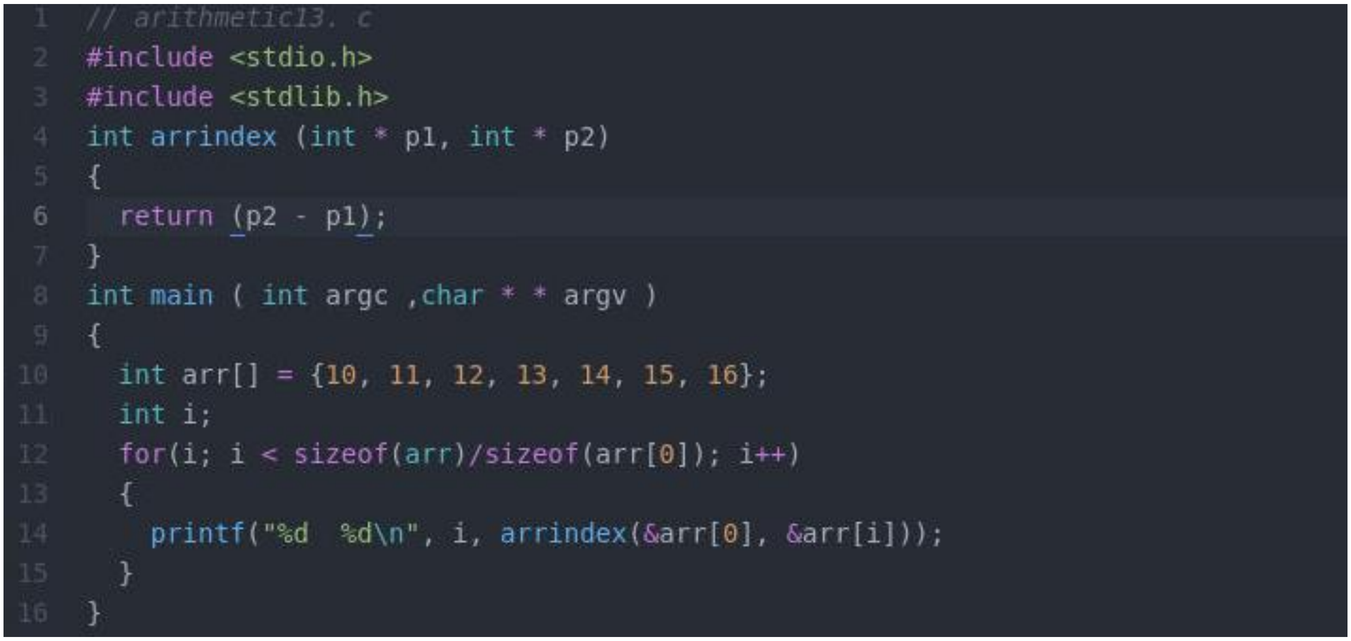
Write and test a C program uses the C function

```
int arrindex (int * p1, int * p2)
```

that given the array of integers and the pointer to the element of this array returns the index value of this array element.

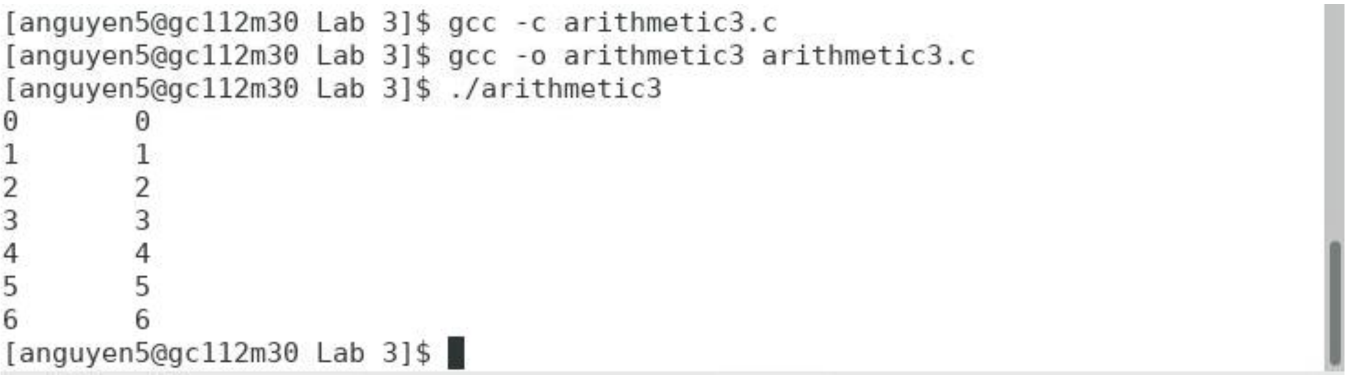
Test your function with the following statements (that needs to be debugged):

```
int arr[] = {10, 11, 12, 13, 14, 15, 16};
for(int i; i < sizeof(arr)/sizeof(arr[0]); i++)
    printf(“%d      %d/n”, i, arrindex(&a[0], &a[i]));
```



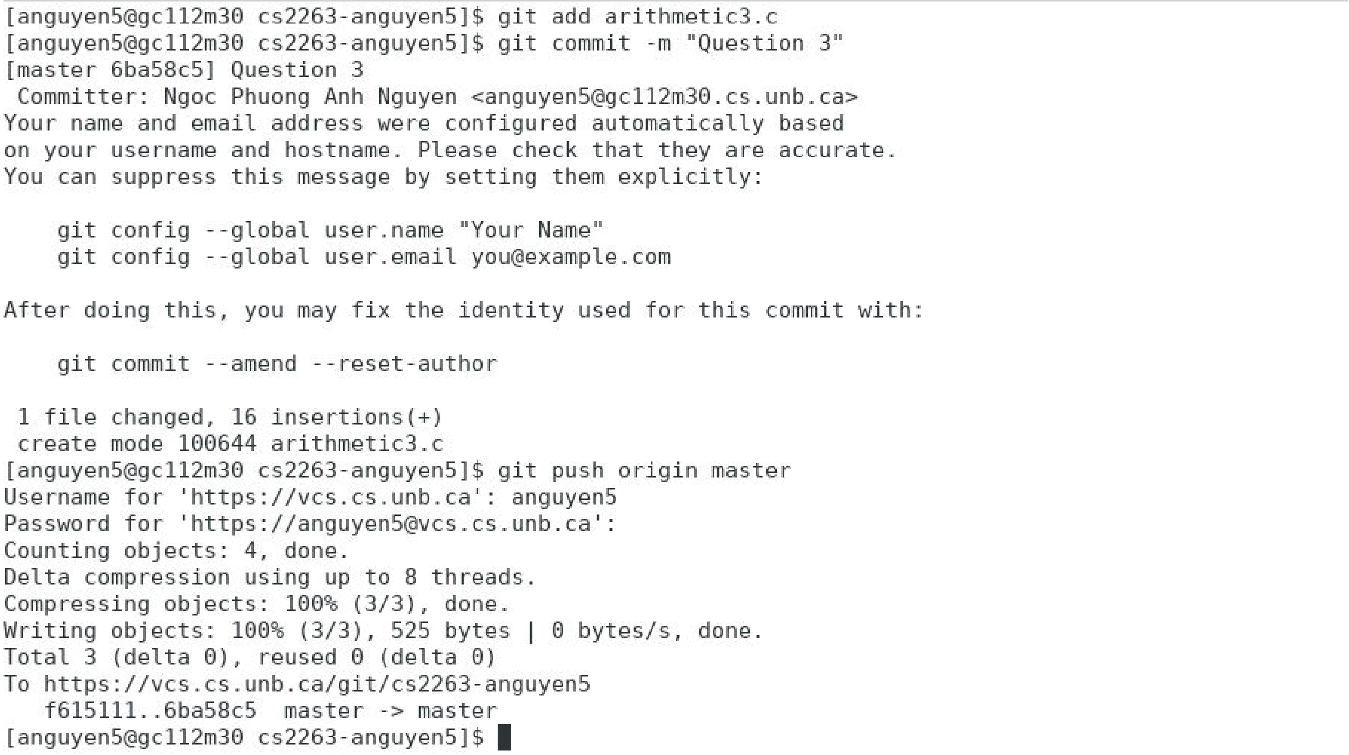
```
// arithmetic13. c
#include <stdio.h>
#include <stdlib.h>
int arrindex (int * p1, int * p2)
{
  return (p2 - p1);
}
int main ( int argc ,char * * argv )
{
  int arr[] = {10, 11, 12, 13, 14, 15, 16};
  int i;
  for(i; i < sizeof(arr)/sizeof(arr[0]); i++)
  {
    printf("%d  %d\n", i, arrindex(&arr[0], &arr[i]));
  }
}
```

Figure 8: The source code



```
[anguyen5@gc112m30 Lab 3]$ gcc -c arithmetic3.c
[anguyen5@gc112m30 Lab 3]$ gcc -o arithmetic3 arithmetic3.c
[anguyen5@gc112m30 Lab 3]$ ./arithmetic3
0       0
1       1
2       2
3       3
4       4
5       5
6       6
[anguyen5@gc112m30 Lab 3]$ 
```

Figure 9: The screen shot of the output from your program



```
[anguyen5@gc112m30 cs2263-anguyen5]$ git add arithmetic3.c
[anguyen5@gc112m30 cs2263-anguyen5]$ git commit -m "Question 3"
[master 6ba58c5] Question 3
 Committer: Ngoc Phuong Anh Nguyen <anguyen5@gc112m30.cs.unb.ca>
Your name and email address were configured automatically based
on your username and hostname. Please check that they are accurate.
You can suppress this message by setting them explicitly:

    git config --global user.name "Your Name"
    git config --global user.email you@example.com

After doing this, you may fix the identity used for this commit with:

    git commit --amend --reset-author

 1 file changed, 16 insertions(+)
 create mode 100644 arithmetic3.c
[anguyen5@gc112m30 cs2263-anguyen5]$ git push origin master
Username for 'https://vcs.cs.unb.ca': anguyen5
Password for 'https://anguyen5@vcs.cs.unb.ca':
Counting objects: 4, done.
Delta compression using up to 8 threads.
Compressing objects: 100% (3/3), done.
Writing objects: 100% (3/3), 525 bytes | 0 bytes/s, done.
Total 3 (delta 0), reused 0 (delta 0)
To https://vcs.cs.unb.ca/git/cs2263-anguyen5
   f615111..6ba58c5  master -> master
[anguyen5@gc112m30 cs2263-anguyen5]$ █
```

Figure 10: The screenshot of you pushing the program source to the FCS git

Exercise Four:

Modify and test the wrongindex.c program from the textbook, page 75. Ignore warnings for the purposes here. Print the memory addresses of x, y, and of all elements of the array arr.

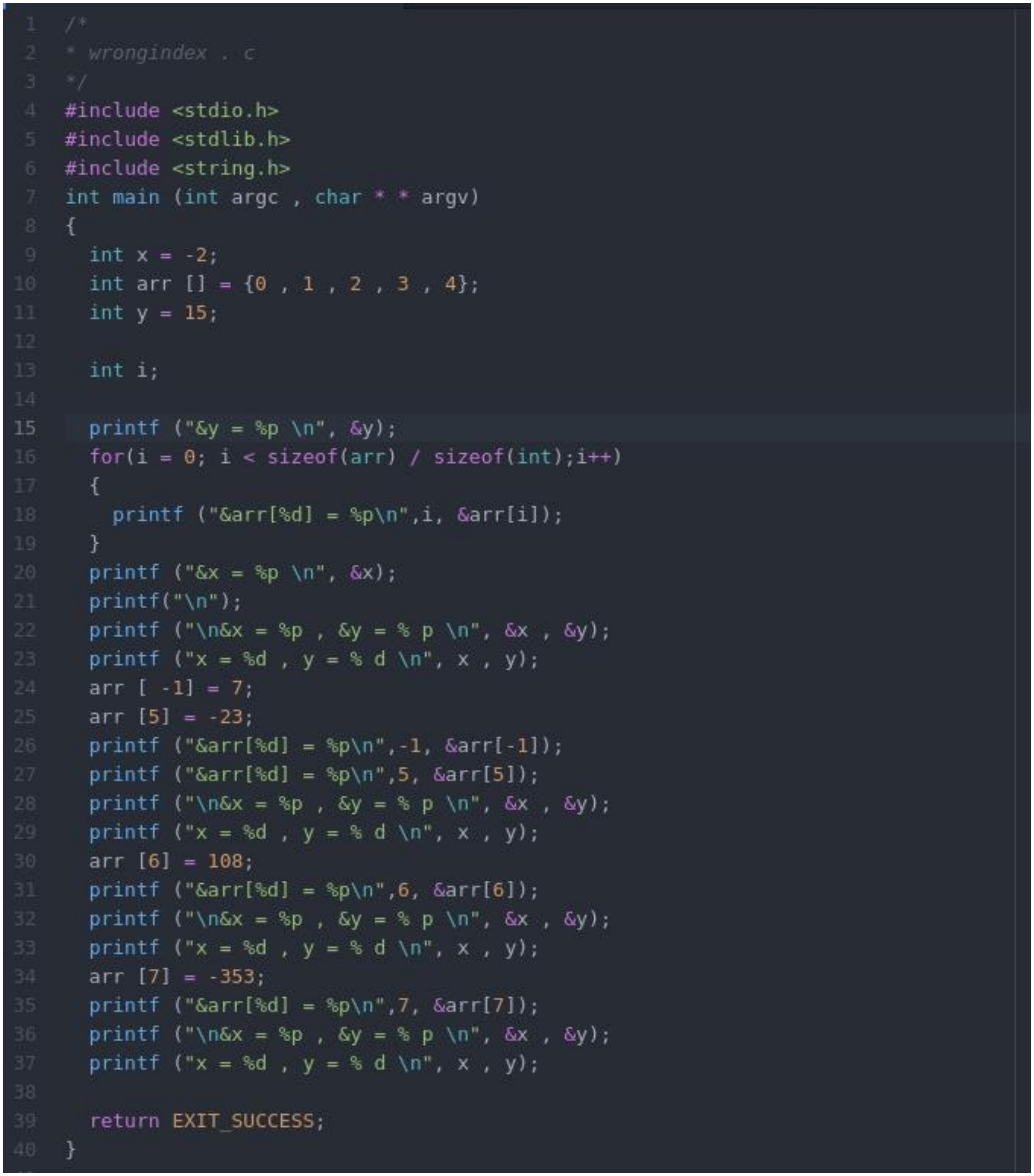
QUESTIONS:

"Draw" the memory stack for your program

Frame	Symbol	Address
	arr[-1]	0x7ffe26eb7a5c
	i	0x7ffe26eb7a58
	y	0x7ffe26eb7a5c
	arr[0]	0x7ffe26eb7a60
	arr[1]	0x7ffe26eb7a64
	arr[2]	0x7ffe26eb7a68
	arr[3]	0x7ffe26eb7a6c
	arr[4]	0x7ffe26eb7a70
	arr[5]	0x7ffe26eb7a74
	arr[6]	0x7ffe26eb7a78
	arr[7]	0x7ffe26eb7a7c
	x	0x7ffe26eb7a78

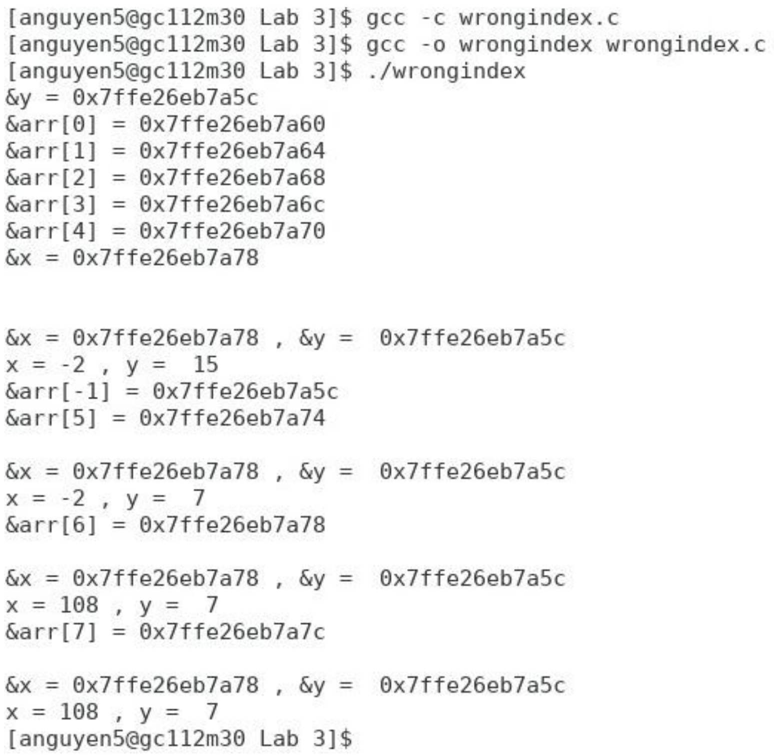
Are the results from your program different from the results shown in the textbook? Explain why

The values are different from the book because of the compilers.



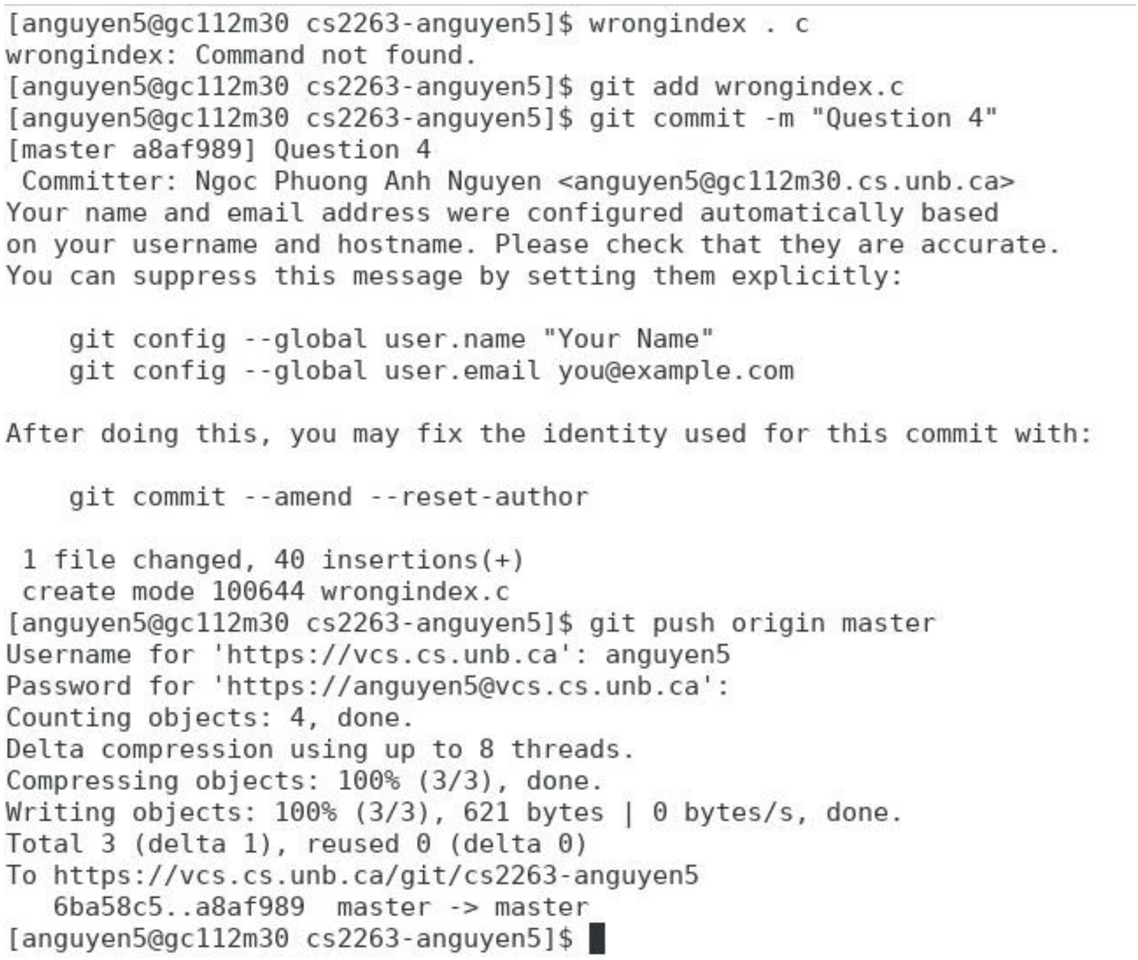
```c
/*
* wrongindex . c
*/
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
int main (int argc , char * * argv)
{
  int x = -2;
  int arr [] = {0 , 1 , 2 , 3 , 4};
  int y = 15;

  int i;

  printf ("&y = %p \n", &y);
  for(i = 0; i < sizeof(arr) / sizeof(int);i++)
  {
    printf ("&arr[%d] = %p\n",i, &arr[i]);
  }
  printf ("&x = %p \n", &x);
  printf("\n");
  printf ("\n&x = %p , &y = % p \n", &x , &y);
  printf ("x = %d , y = % d \n", x , y);
  arr [ -1] = 7;
  arr [5] = -23;
  printf ("&arr[%d] = %p\n",-1, &arr[-1]);
  printf ("&arr[%d] = %p\n",5, &arr[5]);
  printf ("\n&x = %p , &y = % p \n", &x , &y);
  printf ("x = %d , y = % d \n", x , y);
  arr [6] = 108;
  printf ("&arr[%d] = %p\n",6, &arr[6]);
  printf ("\n&x = %p , &y = % p \n", &x , &y);
  printf ("x = %d , y = % d \n", x , y);
  arr [7] = -353;
  printf ("&arr[%d] = %p\n",7, &arr[7]);
  printf ("\n&x = %p , &y = % p \n", &x , &y);
  printf ("x = %d , y = % d \n", x , y);

  return EXIT_SUCCESS;
}
```

Figure 11: The modified source code



```
[anguyen5@gc112m30 Lab 3]$ gcc -c wrongindex.c
[anguyen5@gc112m30 Lab 3]$ gcc -o wrongindex wrongindex.c
[anguyen5@gc112m30 Lab 3]$ ./wrongindex
&y = 0x7ffe26eb7a5c
&arr[0] = 0x7ffe26eb7a60
&arr[1] = 0x7ffe26eb7a64
&arr[2] = 0x7ffe26eb7a68
&arr[3] = 0x7ffe26eb7a6c
&arr[4] = 0x7ffe26eb7a70
&x = 0x7ffe26eb7a78


&x = 0x7ffe26eb7a78 , &y =  0x7ffe26eb7a5c
x = -2 , y =  15
&arr[-1] = 0x7ffe26eb7a5c
&arr[5] = 0x7ffe26eb7a74

&x = 0x7ffe26eb7a78 , &y =  0x7ffe26eb7a5c
x = -2 , y =  7
&arr[6] = 0x7ffe26eb7a78

&x = 0x7ffe26eb7a78 , &y =  0x7ffe26eb7a5c
x = 108 , y =  7
&arr[7] = 0x7ffe26eb7a7c

&x = 0x7ffe26eb7a78 , &y =  0x7ffe26eb7a5c
x = 108 , y =  7
[anguyen5@gc112m30 Lab 3]$
```

Figure 12: The screen shot of the output from your program



```
[anguyen5@gc112m30 cs2263-anguyen5]$ wrongindex . c
wrongindex: Command not found.
[anguyen5@gc112m30 cs2263-anguyen5]$ git add wrongindex.c
[anguyen5@gc112m30 cs2263-anguyen5]$ git commit -m "Question 4"
[master a8af989] Question 4
 Committer: Ngoc Phuong Anh Nguyen <anguyen5@gc112m30.cs.unb.ca>
Your name and email address were configured automatically based
on your username and hostname. Please check that they are accurate.
You can suppress this message by setting them explicitly:

    git config --global user.name "Your Name"
    git config --global user.email you@example.com

After doing this, you may fix the identity used for this commit with:

    git commit --amend --reset-author

 1 file changed, 40 insertions(+)
 create mode 100644 wrongindex.c
[anguyen5@gc112m30 cs2263-anguyen5]$ git push origin master
Username for 'https://vcs.cs.unb.ca': anguyen5
Password for 'https://anguyen5@vcs.cs.unb.ca':
Counting objects: 4, done.
Delta compression using up to 8 threads.
Compressing objects: 100% (3/3), done.
Writing objects: 100% (3/3), 621 bytes | 0 bytes/s, done.
Total 3 (delta 1), reused 0 (delta 0)
To https://vcs.cs.unb.ca/git/cs2263-anguyen5
   6ba58c5..a8af989  master -> master
[anguyen5@gc112m30 cs2263-anguyen5]$ █
```

Figure 13: The screenshot of you pushing the program source to the FCS git

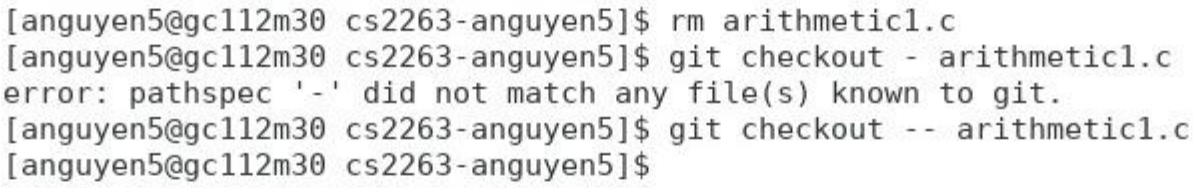
Exercise Five:

remove one of your source files from your local area

```
$ rm <filename>
```

Restore it from the FCS git:

```
$ git checkout -- <filename>
```



```
[anguyen5@gc112m30 cs2263-anguyen5]$ rm arithmetic1.c
[anguyen5@gc112m30 cs2263-anguyen5]$ git checkout - arithmetic1.c
error: pathspec '-' did not match any file(s) known to git.
[anguyen5@gc112m30 cs2263-anguyen5]$ git checkout -- arithmetic1.c
[anguyen5@gc112m30 cs2263-anguyen5]$
```

Figure 14: A screen shot of both your removing and restoring the file from git