# Lab Manual 1 – Pointers, Filing and Debugging

**Important Note:**

- **You may find the syntax to accomplish these exercises from lecture demo.**
- **Names of your submission files should start with your roll number throughout this semester.**
- **Make sure that the interface of your program is user friendly i.e. properly display information.**
- **Properly follow the coding standards.**

## Exercise – Debugging

See the following piece of code and write its output by debugging the code. Keys for debugging are listed below.

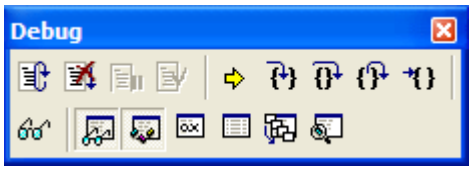
```
int myFunction ()
{
        int numbers[5];
        int * p;
        p = numbers;
        *p = 10;
        p++;
        *p = 20;
        p = &numbers[2];
        *p = 30;
        p = numbers + 3;
        *p = 40;
        p = numbers;
        *(p+4) = 50;

         for (int n=0; n<5; n++)
           cout << numbers[n] << ", ";

         return 0;
}
Void main()
{
        myFunction();
}
```

Write the address of array named ‘numbers’

| 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| | | | | |

| Sr. No | code | Value of p | Address of p | Value of array ‘numbers’ | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | [0] | [1] | [2] | [3] | [4] |
| 1 | int numbers[5]; | | | | | | | |
| 2 | int * p=numbers; | | | | | | | |
| 3 | *p = 10; | | | | | | | |
| 4 | p++; | | | | | | | |
| 5 | *p = 20; | | | | | | | |
| 6 | p = &numbers[2]; | | | | | | | |
| 7 | *p = 30; | | | | | | | |
| 8 | p = numbers + 3; | | | | | | | |
| 9 | *p = 40; | | | | | | | |
| 10 | p = numbers; | | | | | | | |
| 11 | *(p+4) = 50; | | | | | | | |

**Help:** Debugging commands:




| Short cut key | Icon | Menu | Explanation |
|---|---|---|---|
| F-9 | | | Insert/Remove breakpoint |
| F-5 | | Debug-Go | Execute a program until the next breakpoint |
| Shift F-5 | | Debug-Stop debugging | To stop debugging a program. It will stop executing the program |
| F-10 | | Debug-StepOver | Go to the next statement |
| F-11 | | Debug-Step Into | Go inside a function |
| Shift F-11 | | Debug – Step Out | Come out of the function |
| | | Debug - Run to cursor | Execute all statements till the statement on which the cursor is placed or until the next breakpoint |
| Alt -3 | | Debug-Windows-Watch | Show the window where only the variables in scope are shown |
| Alt-4 | | Debug-Windows-Variables | Show the window in which you can type a variable name to see its value |
| Alt-7 | | debug-windows-call stack | You can see the activation of stack of functions here |

## Exercise – Filing

Follow these steps:

1- Create a new cpp file, “filing.cpp”.
2- Create a text file “input.txt” in the current directory.
3- Paste following data in “input.txt”

```
10
21 62 53 94 51 26 97 88 39 111
5
94 73 28 44 95
```

4- Paste the following code in filing.cpp, execute and check what it does.

```
#include<iostream>
#include<fstream>
using namespace std;

void main()
{
	ifstream fin("input.txt");//input file stream, it will work on
file input.txt. Make sure your current cpp file and input.txt are in same
folder

	if(fin.is_open())   //Checking if file has been opened
	{
		//If file has been opened, process it otherwise display
error message

		int size1=0;
		int size2=0;
		int number = 0;


		fin>>size1;		//reading first integer from file

		cout<<"First Array:\n";
		cout<<"Size:\t"<<size1<<endl;
		cout<<"Data:\t";

		for(int i=0 ; i<size1 ; i++)
		{
			//This loop is reading total 10 numbers, where 10 is
Size1

			fin>>number; //Read next integer from file
			cout<<number<<" ";
		}

		fin>>size2;		//reading next integer from file

		cout<<"\n\nSecond Array:\n";
		cout<<"Size:\t"<<size2<<endl;
		cout<<"Data:\t";

		for(int i=0 ; i<size2 ; i++)
		{
		//This loop is reading total 5 numbers, where 5 is Size2

			fin>>number; //Read next integer from file
			cout<<number<<" ";
		}
		cout<<endl;

		fin.close();
			//Close the file as soon as you finish reading it.
	}

	else
	{
```

```
            cout<<"Cannot open file.\n";
        }
}
```

## Exercise – Basic Pointers

Follow these steps:

1. Declare:
    a. Int variables num1, num2 and sum
    b. Int* pointer variables xPtr, yPtr and sumPtr
2. Set num1, num2 and sum to 5, 7 and 0 respectively
3. Initialize all pointers to 0 (nullptr)
4. Print values of variables num1, num2 with labels as shown in the required output below:

    **Required Output:**

```
Num1 = 5
Num2 = 7
```

5. Print the addresses of Num1 and Num2 using Address Operator (&). Required Output (assuming addresses starting from 0x10 for Num1 and so on) is shown below. (Note that addresses will be different on different machines)

    **Required Output:**

```
Num1 = 5
Num2 = 7
Address of Num1 = 0x10 //(This will be different on your machine)
Address of Num 2 = 0x14//(This will be different on your machine)
```

6. Point xPtr to num1 and yPtr to num2
7. Print values of Num1 and Num2 by dereferencing xPtr and yPtr

    **Required Output:**

```
Num1 = 5
Num2 = 7
Address of Num1 = 0x10 //(This will be different on your machine)
Address of Num 2 = 0x14//(This will be different on your machine)
*xPtr = 5
*yPtr = 7
```

8. Point sumPtr to sum and print sum by dereferencing sumPtr.

    **Required Output:**

```
Num1 = 5
Num2 = 7
Address of Num1 = 0x10 //(This will be different on your machine)
Address of Num 2 = 0x14//(This will be different on your machine)
*xPtr = 5
*yPtr = 7
*sumPtr = 0
```

9. Add num1 and num2 using *xPtr and *yPtr and save the result in integer sum
10. Again Print sum using sumPtr

**Required Output:**

```
Num1 = 5
Num2 = 7
Address of Num1 = 0x10 //(This will be different on your machine)
Address of Num 2 = 0x14//(This will be different on your machine)
*xPtr = 5
*yPtr = 7
*sumPtr = 12
```

11. Print the values of xPtr and yPtr (cout<<"xPtr = "<<xPtr<<endl)

**Required Output:**

```
Num1 = 5
Num2 = 7
Address of Num1 = 0x10 //(This will be different on your machine)
Address of Num 2 = 0x14//(This will be different on your machine)
*xPtr = 5
*yPtr = 7
*sumPtr = 12
xPtr = 0x10 //This output should be same as address of num1 i.e. &num1
yPtr = 0x14 //This output should be same as address of num2 i.e. &num2
```

**Help:**

```
cout<<"Num1 = "<<num1<<endl; // Prints Num1 = 5
sum = *xPtr + *yPtr // Add num1 and num2 using *xPtr and *yPtr and save the result in integer sum
```

## Exercise – Expand Array

Write a program that keeps taking integer input from the user until user enters -1 and displays the data in reverse order.

Your program should save the input in a dynamically allocated array. Initially create a dynamic array of five integers. Each time the array gets filled your program should double the size of array (i.e. create a new array of double size, copy previous data in new array, delete previous array) and continue taking the input. After receiving -1 (i.e. end of data input) your program should print the numbers in the reverse order as entered by the user.

**Important Note:** subscript operator [] is not allowed to traverse the array. Use only offset notation. i.e instead of using myArray[i] use *(myArray+i) to read/write an element. **Do not consume extra space. There shouldn't be any memory leakage or dangling pointers in your code.**

## Practice Problems

**Important Note:** Do not consume extra space. There shouldn't be any memory leakage or dangling pointers in your code. **You ARE ALLOWED to use subscript notation (e.g. myArrayPtr[i]) to read/write ith index and integer iterators ARE ALLOWED in loop (i.e. (for int i = 0; i < size; i++)).**

### Question 1 - Compress Array:

Write a program that takes size of an array and its elements and removes consecutive occurrences of same number from the list. For the example given below, your program should have space of exactly 7 integers on heap after compression. Do not consume any extra byte on heap.

Sample Run:

```
Array Before Compression: 1,1,2,2,2,3,4,5,5,5,5,5,7,7,7,2,2,2

Array After Compression: 1,2,3,4,5,7,2
```

## Question 2 - Find Common Elements (Intersection):

Implement a function that finds common elements in two sorted arrays. If array1 = {1,2,3,4,5,6} and array2 is {1,3,5,7}, then array3 (common elements) should be {1,3,5}. Note array3 should not have any duplicate elements and at the end array3 should not consume a single extra byte on heap. You have to:

- Allocate the three arrays dynamically after inputting the size of array1 and array2 from the user. Statically allocated arrays are NOT allowed.
- Initially you can allocate elements = (size of array1 + size of array2) to array3. For example you would allocate 6+4 to array 3 for the above example. After finding the common elements, the allocated size of array3 may be more than what you need. (In the above example you require 3 whereas you have allocated 12).