Lab's Scope:

- **Pointers**

Problem 1:

Write a program initializing two-character variables with values. Assign two pointers to the variables. Change the values using the pointers, then print the new values using the pointers, and print them again using the original variables.

Solution:

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

int main() {
    char first = 'A';
    char second = 'B';
    char* ptr1 = &first;
    char* ptr2 = &second;

    *ptr1 = 'C';
    *ptr2 = 'D';

    cout << first << endl;
    cout << *ptr1 << endl;
    cout << second << endl;
    cout << *ptr2 << endl;

    return 0;
}
```

Problem 2:

Given the following program, trace it and write down its output. *Hint: you better try to draw your memory to have a vision about the content of memory locations*.

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

int main() {
    int a = 42;
    int b = 7;
    int c = 999;
    int* t = &a;
    int* u = NULL;
    cout << *t << endl;

    c = b;
    u = t;
    cout << c << endl;
    cout << *u << endl;

    a = 8;
    b = 8;

    cout << c << endl;
    cout << *t << endl;
    cout << *u << endl;

    *t = 123;
    cout << a << endl;
    cout << b << endl;
    cout << c << endl;
    cout << *t << endl;
    cout << *u << endl;

    return 0;
}
```

Solution:

The output will be as follows:

42
7
42
7
8
8
123
8
7
123
123

Problem 3 :

Write a program that has 3 integer variables and creates three-pointers for these variables. Let your program:

i. Performs an addition and multiplication between the values referred to by these pointers.
ii. Change the values of the three variables.
iii. Repeat the addition and multiplication of the values referred to by the pointers.

Solution:

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

int main() {
    int x = 10;
    int y = 20;
    int z = 30;
    int* xptr = &x;
    int* yptr = &y;
    int* zptr = &z;
    int sum = *xptr + *yptr + *zptr;
    int product = *xptr * *yptr * *zptr;
    cout << "The sum =" << sum << endl;
    cout << "The product =" << product << endl;

    x = 5;
    y = 6;
    x = 7;
    sum = *xptr + *yptr + *zptr;
    product = *xptr * *yptr * *zptr;
    cout << "The sum =" << sum << endl;
    cout << "The product =" << product << endl;

    return 0;
}
```

Problem 4:

Write a program that takes the start and end of a range of numbers and calculates the sum of the elements in the range by using a pointer to the value of the starting element.

Example:

If the start is 30 and the end is 45, then the sum = 30+31+32+...+45 = 600

Solution:

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

int main() {
    int start, end, sum = 0;
    int* ptr;
    cout << "Enter the start:" << endl;
    cin >> start;
    cout << "Enter the end:" << endl;
    cin >> end;
    ptr = &start;

    for (int i = start; i <= end; i++)
    {
        sum += *ptr;
        *ptr = *ptr + 1;
    }
    cout << "The sum =" << sum << endl;
    return 0;
}
```

Problem 5:

Write a program that swaps two integer variables using pointers. (refer to lecture 3 slide 23 if needed)

Solution:

```
using namespace std;
#include <iostream>
int main()
{
	int x = 10;
	int y = 20;
	int* p1 = &x;
	int* p2 = &y;

	int temp = *p1;
	*p1 = *p2;
	*p2 = temp;

	cout << "x= " << x << endl;
	cout << "y= " << y << endl;
	return 0;
}
```

Problem 6:

Write a program to find the sum of integers in an array using pointers to traverse through the array elements. (refer to Lecture 5 slide 24 if needed)

Solution:

```
using namespace std;
#include <iostream>
int main()
{
	const int SIZE = 5;
	int a[SIZE] = {14,16,90,50,33 };
	int* p = a;
	int sum = 0;

	for (int i = 0; i < SIZE; i++)
	{
		sum += *(p + i);
	}
	cout << "The sum is: " << sum << endl;
	return 0;
}
```