بسم الله الرحمن الرحيم

Problem 1 : Random Matrix 3*3

Write a program to fill a 3 *3 matrix with random numbers ?

The following is a 3x3 random matrix :

27 75 19

80 60 12

75 9 28

```
#include <iostream>
#include <iomanip>

using namespace std;

int RandomNumber(int From, int To)
{
	//Function to generate a random number
	int randNum = rand() % (To - From + 1) + From;

	return randNum;
}

void FillMatrixWithRandomNumbers(int arr[3][3], short Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			arr[i][j] = RandomNumber(1, 100);
		}
	}
}

void PrintMatrix(int arr[3][3], short Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			// حجز ثلاث فراغات لوضع الأرقام فيها setw(3)
			cout << setw(3) << arr[i][j] << "     ";
		}
		cout << "\n";
	}
}

int main()
{
	// رقم عشوائي مختلف مع كل استدعاء
	//Seeds the random number generator in C++, called only once
	srand((unsigned)time(NULL));

	// [الثانية لعدد للأعمدة ]  [ الأولى لعدد الصفوف] Matrix تسمى arr[3][3]
	// Variables  9  = 3 * 3 = arr[3][3]
	int arr[3][3];

	FillMatrixWithRandomNumbers(arr, 3, 3);
	cout << "\n The following is a 3x3 random matrix:\n";
	PrintMatrix(arr, 3, 3);

	system("pause>0");
}
```

Problem 2 : Sum Each Row in Matrix

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

int RandomNumber(int From, int To)
{
	//Function to generate a random number
	int randNum = rand() % (To - From + 1) + From;

	return randNum;
}
// Problem #1
void FillMatrixWithRandomNumbers(int arr[3][3],
short Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			arr[i][j] = RandomNumber(1, 100);
		}
	}
}

void PrintMatrix(int arr[3][3], short Rows, short
Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			// حجز ثلاث فراغات لوضع الأرقام فيها
setw(3)

			cout << setw(3) << arr[i][j] << "	";
		}

		cout << "\n";
	}
}

// Problem #2

int RowSum(int arr[3][3], short RowNumber, short Cols)
{
	int Sum = 0;

	// Cols حلقة التكرار في الأعمدة

	for (short j = 0; j <= Cols -1 ; j++)
	{
		Sum += arr[RowNumber][j];
	}
	return Sum;
}
```

Write a program to fill a 3 *3 matrix with random numbers , then print row sum ?

The following is a 3x3 random :matrix

19	83	37
66	61	26
65	60	16

The following are the sum of : each row in the matrix

Row 1 Sum = 139

Row 2 Sum = 153

Row 3 Sum = 141

```
void PrintEachRowSum(int arr[3][3], short Rows, short Cols)
{

	cout << "\nThe following are the sum of each row in the matrix : \n";

	// Row حلقة التكرار في الصفوف

	for (short i = 0; i < Rows; i++)
	{
		cout << " Row " << i + 1 << " Sum = " << RowSum(arr, i, Cols) <<
endl;
	}
}
int main()
{
	// رقم عشوائي مختلف مع كل استدعاء
	//Seeds the random number generator in C++, called only once
	srand((unsigned)time(NULL));

	// Problem #1

	// [الثانية لعدد للأعمدة ]  [ الأولى لعدد الصفوف] Matrix تسمى arr[3][3]
	// Variables  9  = 3 * 3 = arr[3][3]
	int arr[3][3];

	FillMatrixWithRandomNumbers(arr, 3, 3);

	cout << "\n The following is a 3x3 random matrix:\n";
	PrintMatrix(arr, 3, 3);

	// Problem #2

	PrintEachRowSum(arr, 3, 3);

	system("pause>0");
}
```

Problem 3 : Sum Each Row in Matrix in Array

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

int RandomNumber(int From, int To)
{
	//Function to generate a random number
	int randNum = rand() % (To - From + 1) + From;

	return randNum;
}

// Problem #1

void FillMatrixWithRandomNumbers(int arr[3][3],
short Rows, short Cols)
{

	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			arr[i][j] = RandomNumber(1, 100);
		}
	}
}

void PrintMatrix(int arr[3][3], short Rows, short
Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{

			cout << setw(3) << arr[i][j] << "     ";
		}

		cout << "\n";
	}
}
// Problem #2

int RowSum(int arr[3][3], short RowNumber, short Cols)
{
	int Sum = 0;

	for (short j = 0; j <= Cols -1 ; j++)
	{
		Sum += arr[RowNumber][j];
	}
	return Sum;
}
```

Write a program to fill a 3 *3 matrix with random numbers , then sum each row in separate array and print the results ?

The following is a 3x3 random :matrix

72 73 51

76 4 21

35 61 90

The following are the sum of : each row in the matrix

Row 1 Sum = 196

Row 2 Sum = 101

Row 3 Sum = 186

```cpp
// Problem #3

void SumMatrixRowsInArray(int arr[3][3],int arrSum[3], short Rows, short Cols)
{

	// Array جمع عناصر الصف في مصفوفة واحدة

	for (short i = 0; i < Rows; i++)
	{
		arrSum[i] = RowSum(arr, i, Cols);
	}
}

void PrintRowsSumArray(int arr[3], short Rows)
{
	// Array طباعة عناصر المصفوفة

	cout << "\nThe following are the sum of each row in the matrix : \n";

	for (short i = 0; i < Rows; i++)
	{
		cout << " Row " << i + 1 << " Sum = " << arr[i] << endl;
	}
}

int main()
{
	// رقم عشوائي مختلف مع كل استدعاء
	//Seeds the random number generator in C++, called only once
	srand((unsigned)time(NULL));

	// Problem #1
	// [الثانية لعدد للأعمدة ]  [ الأولى لعدد الصفوف] Matrix تسمى arr[3][3]
	// Variables   9  = 3 * 3 = arr[3][3]
	int arr[3][3];
	int arrSum[3];

	FillMatrixWithRandomNumbers(arr, 3, 3);

	cout << "\n The following is a 3x3 random matrix:\n";
	PrintMatrix(arr, 3, 3);

	// Problem #3

	SumMatrixRowsInArray(arr, arrSum, 3, 3);
	PrintRowsSumArray(arrSum, 3);

	system("pause>0");
 }
```

Problem 4 : Sum Each Col in Matrix

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

int RandomNumber(int From, int To)
{
	//Function to generate a random number
	int randNum = rand() % (To - From + 1) + From;

	return randNum;
}

// Problem #1

void FillMatrixWithRandomNumbers(int arr[3][3],
short Rows, short Cols)
{

	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			arr[i][j] = RandomNumber(1, 100);
		}
	}
}

void PrintMatrix(int arr[3][3], short Rows, short
Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{

			cout << setw(3) << arr[i][j] << "      ";
		}

		cout << "\n";
	}
}
// Problem #4

int ColSum(int arr[3][3], short Rows, short ColNumber)
{
	// جمع عناصر العمود

	int Sum = 0;

	for (short i = 0; i <= Rows -1 ; i++)
	{
		Sum += arr[i][ColNumber];
	}
	return Sum;
}
```

Write a program to fill a 3 *3 matrix with random numbers , then print Col sum ?

The following is a 3x3 random :matrix

72 59 68

11 72 9

72 47 53

The following are the sum of : each Col in the matrix

Col 1 Sum = 130

Col 2 Sum = 178

Col 3 Sum = 155

```
void PrintEachColSum(int arr[3][3], short Rows, short Cols)
{
	// طباعة مجموع كل عمود

	cout << "\nThe following are the sum of each Col in the matrix : \n";

	for (short j = 0; j < Cols; j++)
	{
		cout << " Col " << j + 1 << " Sum = " << ColSum(arr, Rows, j) <<
endl;
	}


}

int main()
{
	// رقم عشوائي مختلف مع كل استدعاء
	//Seeds the random number generator in C++, called only once
	srand((unsigned)time(NULL));

	// Problem #1

	// [الثانية لعدد للأعمدة ]  [ الأولى لعدد الصفوف] Matrix تسمى arr[3][3]
	// Variables   9  = 3 * 3 = arr[3][3]
	int arr[3][3];

	FillMatrixWithRandomNumbers(arr, 3, 3);

	cout << "\n The following is a 3x3 random matrix:\n";
	PrintMatrix(arr, 3, 3);

	// Problem #4

	PrintEachColSum(arr, 3, 3);

	system("pause>0");
}
```

Problem 5 : Sum Each Col in Matrix in Another Array

```cpp
#include <iostream>
#include <iomanip>

using namespace std;

int RandomNumber(int From, int To)
{
	int randNum = rand() % (To - From + 1) + From;

	return randNum;
}

// Problem #1

void FillMatrixWithRandomNumbers(int arr[3][3], short Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			arr[i][j] = RandomNumber(1, 100);
		}
	}
}

void PrintMatrix(int arr[3][3], short Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{

			cout << setw(3) << arr[i][j] << "	";
		}

		cout << "\n";
	}
}

// Problem #4

int ColSum(int arr[3][3], short Rows, short ColNumber)
{
	// جمع عناصر العمود

	int Sum = 0;

	for (short i = 0; i <= Rows -1 ; i++)
	{
		Sum += arr[i][ColNumber];
	}
	return Sum;
}
```

Write a program to fill a 3 *3 matrix with random numbers , then sum each Col in another array and print them ?

The following is a 3x3 :random matrix

85 2 56

19 96 94

98 63 22

The following are the sum of : each Col in the matrix

Col 1 Sum = 172

Col 2 Sum = 161

Col 3 Sum = 202

```
// Problem #5

void SumMatrixColsInArray(int arr[3][3], int arrSum[3], short Rows, short Cols)
{
	for (short i = 0; i < Cols; i++)
	{
		arrSum[i] = ColSum(arr , Rows , i);
	}
}

void PrintColsSumArray(int arr[3], short Cols)
{
	cout << "\nThe following are the sum of each Col in the matrix : \n";

	for (short j = 0; j < Cols; j++)
	{
		cout << " Col " << j + 1 << " Sum = " << arr[j] << endl;
	}
}

int main()
{
	// رقم عشوائي مختلف مع كل استدعاء
	//Seeds the random number generator in C++, called only once
	srand((unsigned)time(NULL));

	// Problem #1

	// [الثانية لعدد للأعمدة ]  [ الأولى لعدد الصفوف] Matrix تسمى arr[3][3]
	// Variables   9  = 3 * 3 = arr[3][3]
	int arr[3][3];
	int arrSum[3];

	FillMatrixWithRandomNumbers(arr, 3, 3);

	cout << "\n The following is a 3x3 random matrix:\n";
	PrintMatrix(arr, 3, 3);


	// Problem #5

	SumMatrixColsInArray(arr, arrSum, 3, 3);
	PrintColsSumArray(arrSum, 3);

	system("pause>0");
}
```

Problem 6: 3 * 3 Ordered Matrix

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

// Problem #6

void FillMatrixWithOrderedNumbers(int
arr[3][3], short Rows, short Cols )
{
	int Counter = 0;
	for (short i = 0; i < Rows ; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			Counter++;
			arr[i][j] = Counter;
		}
	}
}

// Problem #1

void PrintMatrix(int arr[3][3], short Rows,
short Cols)
{

	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{

			cout << setw(3) << arr[i][j] << "	";
		}
		cout << "\n";
	}
}

int main()
{
	srand((unsigned)time(NULL));

	int arr[3][3];
	FillMatrixWithOrderedNumbers(arr, 3, 3);

	cout << "\n The following is a 3x3 Ordered matrix:\n";
	PrintMatrix(arr, 3, 3);

	system("pause>0");
}
```

Write a program to fill a 3 *3 matrix with ordered numbers ?

The following is a 3x3 :Ordered matrix

3 2 1

6 5 4

9 8 7

Problem 7 : Transpose Matrix

Write a program to fill a 3 *3 matrix with ordered numbers and print it then transpose matrix and print it ?

The following is a 3x3 :Ordered matrix

3 2 1

6 5 4

9 8 7

The following is the :Transposed matrix

7 4 1

8 5 2

9 6 3

```
#include <iostream>
#include <iomanip>

using namespace std;

// Problem #6

void FillMatrixWithOrderedNumbers(int arr[3][3], short Rows, short Cols )
{
	int Counter = 0;
	for (short i = 0; i < Rows ; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			Counter++;
			arr[i][j] = Counter;
		}
	}
}

// Problem #1

void PrintMatrix(int arr[3][3], short Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			cout << setw(3) << arr[i][j] << "     ";
		}

		cout << "\n";
	}
}


// Problem #7

void TransposeMatrix(int arr[3][3],int arrTransposed [3][3], short Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			arrTransposed [i][j] = arr[j][i];
		}
	}
}
```

```
int main()
{
	// رقم عشوائي مختلف مع كل استدعاء
	//Seeds the random number generator in C++, called only once
	srand((unsigned)time(NULL));

	// Problem #1

	// [الثانية لعدد للأعمدة ]  [ الأولى لعدد الصفوف] Matrix تسمى arr[3][3]
	// Variables   9  = 3 * 3 = arr[3][3]
	int arr[3][3];
	int arrTransposed[3][3];


	// Problem #6

	FillMatrixWithOrderedNumbers(arr, 3, 3);

	cout << "\n The following is a 3x3 Ordered matrix:\n";
	PrintMatrix(arr, 3, 3);

	// Problem #7

	TransposeMatrix(arr, arrTransposed, 3, 3);

	cout << "\n The following is the Transposed matrix:\n";
	PrintMatrix(arrTransposed, 3, 3);


	system("pause>0");
}
```

Problem 8 : Multiply Two Matrix

```
#include <iostream>
#include <iomanip>

using namespace std;

int RandomNumber(int From, int To)
{
	//Function to generate a random number
	int randNum = rand() % (To - From + 1) + From;

	return randNum;
}

// Problem #1

void FillMatrixWithRandomNumbers(int arr[3][3], short
Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			//arr[i][j] = RandomNumber(1, 100);
			arr[i][j] = RandomNumber(1, 10);
		}
	}
}
void PrintMatrix(int arr[3][3], short Rows, short
Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			// حجز ثلاث فراغات لوضع الأرقام فيها
setw(3)ِ

			//cout << setw(3) << arr[i][j] << "
";
			printf(" %0*d  ", 2, arr[i][j]);
		}
		cout << "\n";
	}
}

void MultiplyMatrix(int Matrix1[3][3],int Matrix2[3][3], int MatrixResults[3][3],
short Rows, short Cols)
{

	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			MatrixResults[i][j] = Matrix1[i][j] * Matrix2[i][j];

		}
	}
}
```

Write a program to fill a 3 *3 matrix with random numbers and them then multiply them into a 3rd matrix and print it ?

: Matrix 1

07 10 02

09 07 01

03 09 04

Matrix 2

07 05 10

07 06 06

06 05 03

: Result

49 50 20

63 42 06

18 45 12

```
int main()
{
	// رقم عشوائي مختلف مع كل استدعاء
	//Seeds the random number generator in C++, called only once
	srand((unsigned)time(NULL));

	// Problem #8

	int Matrix1[3][3], Matrix2[3][3] ,MatrixResult[3][3] ;

	FillMatrixWithRandomNumbers(Matrix1, 3, 3);
	cout << "\n Matrix 1 :\n";
	PrintMatrix(Matrix1, 3, 3);

	FillMatrixWithRandomNumbers(Matrix2, 3, 3);
	cout << "\n Matrix 2 \n";
	PrintMatrix(Matrix2, 3, 3);

	MultiplyMatrix(Matrix1, Matrix2, MatrixResult, 3, 3);

	cout << "\n Result : \n";
	PrintMatrix(MatrixResult, 3, 3);

	system("pause>0");
}
```

Problem 9 : Print Middle Row and Col of Matrix

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

int RandomNumber(int From, int To)
{
	int randNum = rand() % (To - From + 1) + From;

	return randNum;
}

// Problem #1

void FillMatrixWithRandomNumbers(int arr[3][3], short
Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			//arr[i][j] = RandomNumber(1,
100);
			arr[i][j] = RandomNumber(1, 10);
		}
	}
}

void PrintMatrix(int arr[3][3], short Rows, short
Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			//cout << setw(3) << arr[i][j] << "     ";
			printf(" %0*d  ", 2, arr[i][j]);
		}
		cout << "\n";
	}
}

// Problem #9

void PrintMiddleRowOfMatrix(int arr[3][3] , short Rows , short Cols)
{
	short MiddleRow = Rows / 2;

	for (short j = 0; j < Cols; j++)
	{
		printf(" %0*d  ", 2, arr[MiddleRow][j]);

	}
	cout << "\n";
}
```

Write a program to fill a 3 *3 matrix with random numbers , print it then print the middle row and middle col ?

: Matrix 1

03 04 05

06 01 06

09 06 06

: Middle Row of Matrix 1 is

06 01 06

: Middle Col of Matrix 1 is

06 01 04

```
void PrintMiddleColOfMatrix(int arr[3][3] , short Rows , short Cols)
{
	short MiddleCol = Cols / 2;

	for (short j = 0; j < Cols; j++)
	{
		printf(" %0*d  ", 2, arr[j][MiddleCol]);

	}
	cout << "\n";
}

int main()
{
	// رقم عشوائي مختلف مع كل استدعاء
	//Seeds the random number generator in C++, called only once
	srand((unsigned)time(NULL));

	int Matrix1[3][3];

	// Problem #9

	FillMatrixWithRandomNumbers(Matrix1, 3, 3);
	cout << "\n Matrix 1 :\n";
	PrintMatrix(Matrix1, 3, 3);

	cout << "\n Middle Row of Matrix 1 is :\n";
	PrintMiddleRowOfMatrix(Matrix1, 3, 3);

	cout << "\n Middle Col of Matrix 1 is :\n";
	PrintMiddleColOfMatrix(Matrix1, 3, 3);

	system("pause>0");
}
```

Problem 10 : Sum Of Matrix

```
#include <iostream>
#include <iomanip>

using namespace std;

int RandomNumber(int From, int To)
{
	int randNum = rand() % (To - From + 1) + From;

	return randNum;
}

// Problem #1

void FillMatrixWithRandomNumbers(int arr[3][3], short
Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			//arr[i][j] = RandomNumber(1, 100);
			arr[i][j] = RandomNumber(1, 10);
		}
	}
}

void PrintMatrix(int arr[3][3], short Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			//cout << setw(3) << arr[i][j] << "     ";
			printf(" %0*d  ", 2, arr[i][j]);
		}
		cout << "\n";
	}
}

// Problem #10

int SumOfMatrix(int Matrix1[3][3], short Rows, short Cols)
{
	int Sum  = 0;
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			Sum += Matrix1[i][j];
		}
	}
	return Sum;
}
```

Write a program to fill a 3 *3 matrix with random numbers and them then write a function to sum all numbers in this matrix and print it ?

: Matrix 1

03 06 04

03 06 10

08 01 07

Sum of matrix 1 is : 48

```
int main()
{
	// رقم عشوائي مختلف مع كل استدعاء
	//Seeds the random number generator in C++, called only once
	srand((unsigned)time(NULL));

	int Matrix1[3][3];

	// Problem #10

	FillMatrixWithRandomNumbers(Matrix1, 3, 3);
	cout << "\n Matrix 1 :\n";
	PrintMatrix(Matrix1, 3, 3);

	cout << "\n Sum of matrix 1 is : " << SumOfMatrix(Matrix1, 3, 3) << endl;

	system("pause>0");
}
```

Problem 11 : Check Matrices Equality

```
#include <iostream>
#include <iomanip>

using namespace std;

int RandomNumber(int From, int To)
{
	int randNum = rand() % (To - From + 1) + From;

	return randNum;
}

// Problem #1

void FillMatrixWithRandomNumbers(int arr[3][3], short
Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			//arr[i][j] = RandomNumber(1, 100);
			arr[i][j] = RandomNumber(1, 10);
		}
	}
}


void PrintMatrix(int arr[3][3], short Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			//cout << setw(3) << arr[i][j] << "     ";
			printf(" %0*d  ", 2, arr[i][j]);
		}
		cout << "\n";
	}
}

// Problem #10

int SumOfMatrix(int Matrix1[3][3], short Rows, short Cols)
{
	int Sum  = 0;
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			Sum += Matrix1[i][j];
		}
	}
	return Sum;
}
```

Write a program to compare two matrices and check if they are equal or not ?

: Matrix 1

06 03 07

08 02 09

10 04 04

: Matrix 2

03 07 06

04 09 09

04 03 06

No : Matrices are NOT equal

```
// Problem #11

bool AreEqualMatrices(int Matrix1[3][3], int Matrix2[3][3], short Rows, short
Cols)
{
	return (SumOfMatrix(Matrix1, Rows, Cols ) == SumOfMatrix(Matrix2, Rows,
Cols));
}

int main()
{
	//Seeds the random number generator in C++, called only once
	srand((unsigned)time(NULL));

	int Matrix1[3][3], Matrix2[3][3];

	// Problem #10

	FillMatrixWithRandomNumbers(Matrix1, 3, 3);
	cout << "\n Matrix 1 :\n";
	PrintMatrix(Matrix1, 3, 3);

	FillMatrixWithRandomNumbers(Matrix2, 3, 3);
	cout << "\n Matrix 2 :\n";
	PrintMatrix(Matrix2, 3, 3);

	// Problem #11

	if (AreEqualMatrices(Matrix1, Matrix2, 3, 3))
		cout << "\n YES : bout Matrices are equal.";
	else
		cout << "\n No : Matrices are NOT equal";

	system("pause>0");
}
```

#Problem 12 : Check Typical Matrices

```
#include <iostream>
#include <iomanip>

using namespace std;

int RandomNumber(int From, int To)
{
	int randNum = rand() % (To - From + 1) +
From;

	return randNum;
}

// Problem #1

void FillMatrixWithRandomNumbers(int arr[3][3],
short Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			//arr[i][j] = RandomNumber(1,
100);
			arr[i][j] = RandomNumber(1,
10);
		}
	}
}


void PrintMatrix(int arr[3][3], short Rows, short
Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			//cout << setw(3) << arr[i][j] << "     ";
			printf(" %0*d  ", 2, arr[i][j]);
		}
		cout << "\n";
	}
}
```

Write a program to compare two matrices and check if they are typical or not ?

: Matrix 1

03 06 03

10 01 05

02 05 07

: Matrix 2

07 05 03

09 06 09

03 08 03

No : Matrices are NOT Typical

```
// Problem #12

bool AreTypicalMatrices (int Matrix1[3][3], int Matrix2[3][3], short Rows, short
Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			if (Matrix1[i][j] != Matrix2[i][j])
			{
				return false;
			}
		}
	}
	return true;
}

int main()
{
	//Seeds the random number generator in C++, called only once
	srand((unsigned)time(NULL));

	int Matrix1[3][3], Matrix2[3][3];

	FillMatrixWithRandomNumbers(Matrix1, 3, 3);
	cout << "\n Matrix 1 :\n";
	PrintMatrix(Matrix1, 3, 3);

	FillMatrixWithRandomNumbers(Matrix2, 3, 3);
	cout << "\n Matrix 2 :\n";
	PrintMatrix(Matrix2, 3, 3);


	if (AreTypicalMatrices (Matrix1, Matrix2, 3, 3))
		cout << "\n YES : both Matrices are Typical.";
	else
		cout << "\n No : Matrices are NOT Typical";

	system("pause>0");
}
```

#Problem 13 : Check Identity Matrix

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

void PrintMatrix(int arr[3][3], short Rows, short Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
		cout << setw(3) << arr[i][j] << "     ";
			//printf(" %0*d  ", 2, arr[i][j]);
		}
		cout << "\n";
	}
}

// Problem #13

bool IsIdentityMatrix(int Matrix[3][3], short Rows,
short Cols)
{
// Check Diagonal elements are 1 and rest elements are 0

	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			// check for diagonals element
			if (i == j && Matrix[i][j] != 1)
			{
				return false;
			}
			// check for rest elements
			else if (i != j && Matrix[i][j] != 0)
			{
				return false;
			}
		}
	}
	return true;
}
int main()
{
	// Problem #13

	//int Matrix[3][3] = { {1,2,3},{4,5,6}, {7,8,9} };
	int Matrix[3][3] = { {1,0,0},{0,1,0}, {0,0,1} };

	cout << "\n Matrix  :\n";
	PrintMatrix(Matrix, 3, 3);

	if (IsIdentityMatrix(Matrix, 3, 3))
		cout << "\n YES : Matrix is Identity.";
	else
		cout << "\n No : Matrix is NOT Identity.";

	system("pause>0");
}
```

Write a program to check if the matrix is identity or not ?

: Matrix

0 0 1

0 1 0

1 0 0

.YES : Matrix is Identity

#Problem 14 : Check Scalar Matrix

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

void PrintMatrix(int arr[3][3], short Rows, short
Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
		cout << setw(3) << arr[i][j] << "     ";
			//printf(" %0*d  ", 2, arr[i][j]);
		}
		cout << "\n";
	}
}
// Problem #14

bool IsScalarMatrix(int Matrix[3][3], short Rows,
short Cols)
{
	int FirstDiagElement = Matrix[0][0];

	// Check Diagonal elements are 1 and rest elements are 0
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			// check for diagonals element
			if (i == j && Matrix[i][j] != FirstDiagElement)
			{
				return false;
			}
			// check for rest elements
			else if (i != j && Matrix[i][j] != 0)
			{
				return false;
			}
		}
	}
	return true;
}
int main()
{
	int Matrix[3][3] = { {9,0,0},{0,9,0}, {0,0,9} };

	// Problem #14

	cout << "\n Matrix  :\n";
	PrintMatrix(Matrix, 3, 3);

	if (IsScalarMatrix(Matrix, 3, 3))
		cout << "\n YES : Matrix is Scalar.";
	else
		cout << "\n No : Matrix is NOT Scalar.";

	system("pause>0");
}
```

Write a program to check if the matrix is scalar or not

: Matrix

0 0 9

0 9 0

9 0 0

.YES : Matrix is Scalar

#Problem 15 : Count Number in Matrix

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

void PrintMatrix(int arr[3][3], short Rows, short
Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
		cout << setw(3) << arr[i][j] << "	";
			//printf(" %0*d  ", 2, arr[i][j]);
		}
		cout << "\n";
	}
}

// Problem #15

short CountNumberInMatrix( int Matrix[3][3], int
Number ,short Rows, short Cols)
{
	short NumberCount = 0;

	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			if (Matrix[i][j] == Number)
				NumberCount++;
		}
	}
	return NumberCount;
}
int main()
{
	int Matrix[3][3] = { {9,1,12},{0,9,1}, {0,9,9} };
	// Problem #15

	cout << "\n Matrix  :\n";
	PrintMatrix(Matrix, 3, 3);

	int Number;
	cout << "\n Enter the number to count in matrix ? ";
	cin >> Number;

	cout <<"\n Number " << Number << " Count in matrix is "
		<< CountNumberInMatrix(Matrix,Number, 3, 3) << endl;

	system("pause>0");
}
```

Write a program to count given number in matrix ?

: Matrix

12 1 9

1 9 0

9 9 0

Enter the number to count in matrix ? 9

Number 9 Count in matrix is 4

#Problem 16 : Check Sparse Matrix

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

void PrintMatrix(int arr[3][3], short Rows, short
Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
		cout << setw(3) << arr[i][j] << "     ";
			//printf(" %0*d  ", 2, arr[i][j]);
		}
		cout << "\n";
	}
}

// Problem #15

short CountNumberInMatrix( int Matrix[3][3], int
Number ,short Rows, short Cols)
{
	short NumberCount = 0;

	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			if (Matrix[i][j] == Number)
				NumberCount++;
		}
	}
	return NumberCount;
}

// Problem #16

short IsSparseMatrix( int Matrix[3][3] ,short Rows, short Cols)
{
	short MatrixSize = Rows * Cols ;

	return (CountNumberInMatrix(Matrix, 0, 3, 3) >= (MatrixSize / 2));
}
int main()
{
	int Matrix[3][3] = { {0,0,12},{0,0,1}, {0,0,9} };
	// Problem #16

	cout << "\n Matrix  :\n";
	PrintMatrix(Matrix, 3, 3);

	if (IsSparseMatrix(Matrix, 3, 3))
		cout << "\n YES : it is Sparse.\n";
	else
		cout << "\n No : it's NOT Sparse.\n";

	system("pause>0");
}
```

Write a program to check if the matrix is Sparse or ?

: Matrix

12 0 0

1 0 0

9 0 0

.YES : it is Sparse

#Problem 17 : Number Exists In Matrix

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

void PrintMatrix(int arr[3][3], short Rows, short
Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
		cout << setw(3) << arr[i][j] << "	";
			//printf(" %0*d  ", 2, arr[i][j]);
		}
		cout << "\n";
	}
}

// Problem #17

bool IsNumberInMatrix(int Matrix[3][3], int Number,
short Rows, short Cols)
{

	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			if (Matrix[i][j] == Number)
				return true;
		}
	}
	return false;

}

int main()
{
	int Matrix[3][3] = { {77,5,12},{22,20,1}, {1,0,9} };

	// Problem #17

	cout << "\n Matrix  :\n";
	PrintMatrix(Matrix, 3, 3);

	int Number;
	cout << "\n Enter the number to look for in matrix ?  ";
	cin >> Number;

	if (IsNumberInMatrix(Matrix, Number, 3, 3))
		cout << "\n YES : it is there.\n";
	else
		cout << "\n No : it's NOT there.\n";

	system("pause>0");
}
```

Write a program to check if a given number exists in matrix or not ?

: Matrix

12 5 77

1 20 22

9 0 1

Enter the number to look for in matrix ? 77

.YES : it is there

#Problem 18 : Intersected Numbers in matrices

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

void PrintMatrix(int arr[3][3], short Rows, short
Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
		cout << setw(3) << arr[i][j] << "	";
			//printf(" %0*d  ", 2, arr[i][j]);
		}
		cout << "\n";
	}
}

// Problem #17

bool IsNumberInMatrix(int Matrix[3][3], int Number,
short Rows, short Cols)
{

	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			if (Matrix[i][j] == Number)
				return true;
		}
	}
	return false;

}

// Problem #18

void PrintIntersectedNumbers(int Matrix1[3][3], int
Matrix2[3][3], short Rows, short Cols)
{
	int Number;

	for (short i = 0; i <= Rows - 1; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			Number = Matrix1[i][j];

			if (IsNumberInMatrix( Matrix2 , Number , Rows , Cols))
			{
				cout << setw(3) << Number << "	";
			}
		}
	}

}
```

Write a program to print the intersected numbers in two given matrices ?

: Matrix

12 5 77

1 20 22

9 0 1

: Matrix 3

90 80 5

1 77 22

33 8 10

Intersected Numbers : are

1 1 22 5 77

```
int main()
{
	int Matrix[3][3] = { {77,5,12},{22,20,1}, {1,0,9} };
	int Matrix3[3][3] = { {5,80,90},{22,77,1}, {10,8,33} };


	// Problem #18

	cout << "\n Matrix  :\n";
	PrintMatrix(Matrix, 3, 3);

	cout << "\n Matrix 3 :\n";
	PrintMatrix(Matrix3, 3, 3);

	cout << "\n Intersected Numbers are : \n\n";
	PrintIntersectedNumbers(Matrix, Matrix3, 3, 3);




	system("pause>0");
}
```

#Problem 19 : Min / Max Number in matrix

```
#include <iostream>
#include <iomanip>
using namespace std;
void PrintMatrix(int arr[3][3], short Rows, short
Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
		cout << setw(3) << arr[i][j] << "	";
		}
		cout << "\n";
	}
}
// Problem #19
int MinNumberInMatrix(int Matrix[3][3], short Rows,
short Cols)
{
	int Min = Matrix[0][0];

	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			if ( Matrix[i][j] < Min)
				Min = Matrix[i][j] ;
		}
	}
	return Min;
}
int MaxNumberInMatrix(int Matrix[3][3], short Rows,
short Cols)
{
	int Max = Matrix[0][0];

	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
			if ( Matrix[i][j] > Max)
				Max = Matrix[i][j] ;
		}
	}
	return Max;
}
int main()
{
	int Matrix[3][3] = { {77,5,12},{22,20,6}, {14,3,9} };

	// Problem #19
	cout << "\n Matrix  :\n";
	PrintMatrix(Matrix, 3, 3);

	cout << "\n Minimum Number is : " <<
		MinNumberInMatrix(Matrix, 3, 3) << endl;
	cout << "\n Max Number is : " <<
		MaxNumberInMatrix(Matrix, 3, 3) << endl;

	system("pause>0"); }
```

Write a program to print the Minimum and Maximum Numbers in Matrix ?

: Matrix

12 5 77

6 20 22

9 3 14

Minimum Number is : 3

Max Number is : 77

#Problem 20 : Palindrome Matrix

```cpp
#include <iostream>
#include <iomanip>

using namespace std;

void PrintMatrix(int arr[3][3], short Rows, short
Cols)
{
	for (short i = 0; i < Rows; i++)
	{
		for (short j = 0; j < Cols; j++)
		{
		cout << setw(3) << arr[i][j] << "	";
		}
		cout << "\n";
	}
}

// Problem #20

bool IsPalindromeMatrix(int Matrix[3][3], short Rows,
short Cols)
{

	for (short i = 0; i < Rows; i++)
	{
		// إذا وصل التحقق الى المنتصف فلا داعي
للتحقق من الطرف الآخر – المحقق سابقا Cols / 2
		for (short j = 0; j < Cols / 2 ; j++)
		{
			if (Matrix[i][j] != Matrix[i][Cols - 1 - j ])
				return false;
		}
	}

	return true;

}

int main()
{
	int Matrix[3][3] = { {1,2,1},{5,5,5}, {7,3,7} };

	// Problem #20

	cout << "\n Matrix  :\n";
	PrintMatrix(Matrix, 3, 3);


	if (IsPalindromeMatrix(Matrix, 3, 3))
	cout << "\n YES : Matrix is Palindrome.\n";
	else
	cout << "\n No : Matrix is NOT Palindrome.\n";


	system("pause>0");
}
```

Write a program to check it the matrix is Palindrome or not ?

: Matrix

1 2 1

5 5 5

7 3 7

YES : Matrix is .Palindrome

#Problem 21: Fibonacci Series

Write a program to print Fibonacci Series of 10 ?

55 34 21 13 8 5 3 2 1 1

```
#include <iostream>
#include <iomanip>

using namespace std;


// Problem #21

void PrintFibonacciUsingLoop( short Number)
{
	int  FebNumber = 0 ;
	int Prev2 = 0, Prev1 =1;

	cout << "1   ";

		for (short i = 2; i <= Number; i++)
		{
			FebNumber = Prev1 + Prev2;

			cout << FebNumber << "   ";

			Prev2 = Prev1 ;
			Prev1 = FebNumber;

		}

}


int main()
{
	// Problem #21

	PrintFibonacciUsingLoop(10);

	system("pause>0");
}
```

#Problem 22 : Fibonacci Series with Recursion

Write a program to print Fibonacci Series of 10 ?

55 34 21 13 8 5 3 2 1 1

```
#include <iostream>
#include <iomanip>

using namespace std;


// Problem #22

void PrintFibonacciUsingRecurssion( short Number ,int Prev1 ,int Prev2)
{
	int  FebNumber = 0;

		if ( Number > 0)
		{
			FebNumber = Prev2 + Prev1;

			Prev2 = Prev1;
			Prev1 = FebNumber;

			cout << FebNumber << "   ";

			PrintFibonacciUsingRecurssion(Number -1 , Prev1  , Prev2);
		}

}


int main()
{
	// Problem #22

	PrintFibonacciUsingRecurssion(10, 0, 1);

	system("pause>0");
}
```

#Problem 23 : Print First Letter of Each Word

```
#include <iostream>
#include <string>
#include <iomanip>

using namespace std;


// Problem #23

string ReadString()
{
	string S1 = " ";

	cout << "Pleas Enter your string ? \n";
	getline(cin, S1);

	return S1;

}

void PrintFirstLetterOfEachWord(string S1)
{
	bool isFirstLetter = true;

	cout << "\n First letters of this string :
\n";

	for (int i = 0; i < S1.length(); i++)
	{
		if (S1[i] != ' ' && isFirstLetter)
		{
			cout << S1[i] << endl;
		}

		isFirstLetter = (S1[i] == ' ' ? true : false);
	}
}

int main()
{
	// Problem #23

	PrintFirstLetterOfEachWord(ReadString());

	system("pause>0");
}
```

Write a program to read a string then print the first letter of each word in that string ?

```
? Pleas Enter your string

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First letters of this string

M

S

A

@

A
```

#Problem 24 : Upper First Letter of Each Word

Write a program to read a string then Uppercase the first letter of each word in that string ?

? Pleas Enter your string

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: String after Conversion

Mohammed Saqer Abu-Hadhoud

```
#include <iostream>
#include <string>
#include <iomanip>

using namespace std;


// Problem #23

string ReadString()
{
	string S1 = " ";

	cout << "Pleas Enter your string ? \n";
	getline(cin, S1);

	return S1;

}

// Problem #24

string UpeerFirstLetterOfEachWord(string S1)
{
	bool isFirstLetter = true;

	for (int i = 0; i < S1.length(); i++)
	{
		if (S1[i] != ' ' && isFirstLetter)
		{
			S1[i] = toupper(S1[i]);
		}

		isFirstLetter = (S1[i] == ' ' ? true : false);
	}
	return S1;
}

int main()
{
	// Problem #24

	string S1 = ReadString();

	cout << "\n String after Conversion : \n";
	S1 = UpeerFirstLetterOfEachWord(S1);
	cout << S1 << endl;

	system("pause>0");
}
```

#Problem 25 : Lower First Letter of Each Word

Write a program to read a string then Lowercase the first letter of each word in that string ?

? Pleas Enter your string

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: String after Conversion

mohammed saqer abu-Hadhoud

```
#include <iostream>
#include <string>
#include <iomanip>

using namespace std;


// Problem #23

string ReadString()
{
	string S1 = " ";

	cout << "Pleas Enter your string ? \n";
	getline(cin, S1);

	return S1;

}


// Problem #25

string LowerFirstLetterOfEachWord(string S2)
{
	bool isFirstLetter = true;

	for (int i = 0; i < S2.length(); i++)
	{
		if (S2[i] != ' ' && isFirstLetter)
		{
			S2[i] = tolower(S2[i]);
		}

		isFirstLetter = (S2[i] == ' ' ? true : false);
	}
	return S2;
}

int main()
{
	// Problem #25

	string S2 = ReadString();

	cout << "\n String after Conversion : \n";
	S2 = LowerFirstLetterOfEachWord(S2);
	cout << S2 << endl;

	system("pause>0");
}
```

#Problem 26 : Upper / Lower All Letter of a string

```
#include <iostream>
#include <string>
#include <iomanip>

using namespace std;

// Problem #23

string ReadString()
{
	string S1 = " ";

	cout << "Pleas Enter your string ? \n";
	getline(cin, S1);

	return S1;

}

// Problem #26

string UpperAllString(string S3)
{

	for (int i = 0; i < S3.length(); i++)
	{
		S3[i] = toupper(S3[i]);
	}
	return S3;
}

string LowerAllString(string S3)
{

	for (int i = 0; i < S3.length(); i++)
	{
		S3[i] = tolower(S3[i]);
	}
	return S3;
}

int main()
{
	// Problem #26

	string S3 = ReadString();

	cout << "\n String after Upper : \n";
	S3 = UpperAllString(S3);
	cout << S3 << endl;

	cout << "\n String after Lower : \n";
	S3 = LowerAllString(S3);
	cout << S3 << endl;

	system("pause>0");
}
```

Write a program to read a string then Upper all letters , then Lower all letters and Print them ?

? Pleas Enter your string

Mohammed Saqer Abu-Hadhoud

: String after Upper

MOHAMMED SAQER ABU-HADHOUD

: String after Lower

mohammed saqer abu-hadhoud

#Problem 27 : Invert Character Case

```cpp
#include <iostream>
#include <string>
#include <iomanip>

using namespace std;

// Problem #27

char ReadChar()
{
	char Ch1 ;

	cout << "Pleas Enter a Character ? \n";
	cin >> Ch1;

	return Ch1;

}


char InvertLetterCase(char Char1)
{

// ترجع true إذا كان الحرف كبيرا وإلا false إذا كان الحرف صغيرا isupper(Char1)

	return isupper(Char1) ? tolower(Char1) : toupper(Char1);
}

int main()
{
	// Problem #27

	char Ch1 = ReadChar();

	cout << "\n Char after inverting case : \n";
	Ch1 = InvertLetterCase(Ch1);
	cout << Ch1 << endl;

	system("pause>0");
}
```

Write a program to read a Character then invert it's case and Print it ?

? Pleas Enter a Character

a

: Char after inverting case

A

#Problem 28 : Invert All Letters Case

```cpp
#include <iostream>
#include <string>
#include <iomanip>

using namespace std;

// Problem #23

string ReadString()
{
	string S1 = " ";

	cout << "Pleas Enter your string ? \n";
	getline(cin, S1);

	return S1;

}

// Problem #27

char InvertLetterCase(char Char1)
{
	// إذا كان الحرف كبيرا وإلا false إذا كان الحرف صغيرا
true ترجع isupper(Char1)
	return isupper(Char1) ? tolower(Char1) :
toupper(Char1);
}

// Problem #28

string InvertAllStringLetterCase(string S1)
{
	for (int i = 0; i < S1.length(); i++)
	{
		S1[i] = InvertLetterCase(S1[i]);
	}
	return S1;
}

int main()
{
	// Problem #28

	string S4 = ReadString();

	cout << "\n String after Invert All String Letter Case : \n";
	S4 = InvertAllStringLetterCase(S4);
	cout << S4 << endl;

	system("pause>0");
}
```

Write a program to read a string then Invert all its letter's case and print it ?

? Pleas Enter your string

mohammed
ABU-HADHOUD

String after Invert All
: String Letter Case

MOHAMMED
abu-hadhoud

#Problem 29 : Count Small / Capital Letters

```cpp
#include <iostream>
#include <string>
#include <iomanip>

using namespace std;

// Problem #23

string ReadString()
{
	string S1 = " ";

	cout << "Pleas Enter your string ? \n";
	getline(cin, S1);

	return S1;

}

// Problem #29

short CountCapitalLetters(string S1)
{
	short Counter = 0;

	for (int i = 0; i < S1.length(); i++)
	{
		if (isupper(S1[i]))
			Counter++;

	}
	return Counter;
}


short CountSmallLetters(string S1)
{
	short Counter = 0;

	for (int i = 0; i < S1.length(); i++)
	{
		// islower(Char1) ترجع true إذا كان الحرف كبيرا وإلا false إذا كان الحرف صغيرا

		if (islower(S1[i]))
			Counter++;

	}
	return Counter;
}
```

Write a program to read a string then count Small / Capital letters in that string ?

? Pleas Enter your string

Mohammed Abu-Hadhoud

String Length = 20

Capital Letters Count = 3

Small Letters Count = 15

Method

String Length = 20

Capital Letters Count = 3

Small Letters Count = 15

```
// الحل بطريقة أخرى : دمج Functions مع بعض

enum enWhatToCount {SmallLetters = 0 , CapitalLetters = 1 , All = 3};

short CountLetters(string S5, enWhatToCount WhatToCount = enWhatToCount::All)
{
	// enWhatToCount WhatToCount = enWhatToCount::All
	// All إذا لم تحدد خيار للمقانة يرجع بشكل تلقائي
	if (WhatToCount == enWhatToCount::All)
	{
		return S5.length();
	}

	short Counter = 0;

	for (int i = 0; i < S5.length(); i++)
	{
		if (WhatToCount == enWhatToCount::CapitalLetters && isupper(S5[i]))
			Counter++;

		if (WhatToCount == enWhatToCount::SmallLetters && islower(S5[i]))
			Counter++;

	}
	return Counter;

}
int main()
{
	// Problem #29

	string S5 = ReadString();

	cout << "\nString Length = " << S5.length();
	cout << "\nCapital Letters Count = " << CountCapitalLetters(S5);
	cout << "\nSmall Letters Count = " << CountSmallLetters(S5);

	cout << "\n\nMethod \n";

	cout << "\nString Length = " << CountLetters(S5);
	cout << "\nCapital Letters Count = " << CountLetters(S5,
enWhatToCount::CapitalLetters);
	cout << "\nSmall Letters Count = " << CountLetters(S5,
enWhatToCount::SmallLetters);



	system("pause>0");
}
```

#Problem 30 : Count Letters

```
#include <iostream>
#include <string>
#include <iomanip>

using namespace std;

// Problem #23

string ReadString()
{
	string S1 = " ";

	cout << "Pleas Enter your string ? \n";
	getline(cin, S1);

	return S1;

}

// Problem #27

char ReadChar()
{
	char Ch1 ;

	cout << "Pleas Enter a Character ? \n";
	cin >> Ch1;

	return Ch1;

}

// Problem #30

short CountLetter(string S6 , char Letter)
{
	short Counter = 0;
	for (short i = 0; i <= S6.length(); i++)
	{
		if (S6[i] == Letter)
			Counter++;
	}
	return Counter;
}
int main()
{
	// Problem #30

	string S6 = ReadString();
	char Ch2 = ReadChar();

	cout << "\nLetter \'" << Ch2 << "\' count = " << CountLetter(S6, Ch2) <<
endl;

	system("pause>0");
}
```

Write a program to read a string and read character then count the character in that string ?

? Pleas Enter your string

Mohammed Abu-Hadhoud

? Pleas Enter a Character

m

Letter 'm' count = 2

#Problem 31: Count Letters (Match Case)

```
#include <iostream>
#include <string>
#include <iomanip>

using namespace std;

// Problem #23

string ReadString()
{
	string S1 = " ";

	cout << "Pleas Enter your string ? \n";
	getline(cin, S1);

	return S1;

}

// Problem #27

char ReadChar()
{
	char Ch1 ;

	cout << "Pleas Enter a Character ? \n";
	cin >> Ch1;

	return Ch1;

}

char InvertLetterCase(char Char1)
{
	// إذا كان الحرف صغيرا true ترجع isupper(Char1) إذا كان الحرف كبيرا وإلا false
	return isupper(Char1) ? tolower(Char1) : toupper(Char1);
}
```

Write a program to read a string and read character then count the character in that string (Match Case or Not) ?

? Pleas Enter your string

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Programming Advices

? Pleas Enter a Character

m

Letter 'm' count = 4

Letter 'm' or 'M' Count = 5

```
// Problem #30
// Problem #31

short CountLetter(string S6 , char Letter , bool MatchCase = true)
{
	short Counter = 0;

	for (short i = 0; i <= S6.length(); i++)
	{
		if (MatchCase)
		{
			if (S6[i] == Letter)
				Counter++;
		}
		else
		{
			// تحويل الأحرف الى Small للمقارنة فقط
			if (tolower( S6[i]) == tolower(Letter))
				Counter++;

		}
	}
	return Counter;
}


int main()
{
	// Problem #31

	string S6 = ReadString();
	char Ch3 = ReadChar();

	cout << "\nLetter \'" << Ch3 << "\' count = " << CountLetter(S6 , Ch3) ;

	cout << "\nLetter \'" << Ch3 << "\'";
	cout << "or \'" << InvertLetterCase(Ch3) << "\' ";
	cout << " Count = " << CountLetter(S6, Ch3, false);


	system("pause>0");
}
```

#Problem 32 : Is Vowel ?

```
#include <iostream>
#include <string>
#include <iomanip>

using namespace std;

// Problem #27

char ReadChar()
{
	char Ch1 ;

	cout << "Pleas Enter a Character ? \n";
	cin >> Ch1;

	return Ch1;

}


// Problem #32

bool IsVowel(char Ch4)
{
	Ch4 = tolower(Ch4);

	return ((Ch4 == 'a') ||(Ch4 == 'e') ||(Ch4 == 'i') ||(Ch4 == 'o') ||(Ch4
== 'u')) ;


}

int main()
{
	// Problem #32

	char Ch4 = ReadChar();

	if (IsVowel(Ch4))
		cout << "\nYes Letter \'" << Ch4 << "\' is Vowel";
	else
		cout << "\nNo Letter \'" << Ch4 << "\' is NOT Vowel";


	system("pause>0");
}
```

Write a program to read a character the check if it is a Vowel or Not
(Vowel are : a , e , I , o , u)

? Pleas Enter a Character

a

Yes Letter 'a' is Vowel

#Problem 33 : Count Vowel

```
#include <iostream>
#include <string>
#include <iomanip>

using namespace std;

// Problem #23

string ReadString()
{
	string S1 = " ";

	cout << "Pleas Enter your string ? \n";
	getline(cin, S1);

	return S1;

}


// Problem #32

bool IsVowel(char Ch4)
{
	Ch4 = tolower(Ch4);

	return ((Ch4 == 'a') ||(Ch4 == 'e') ||(Ch4 == 'i') ||(Ch4 == 'o') ||(Ch4
== 'u')) ;


}

// Problem #33

short CountVowels(string S7)
{
	short Counter = 0;

	for (short i = 0; i < S7.length(); i++)
	{
		if (IsVowel(S7[i]))
		{
			Counter++;
		}
	}
	return Counter;
}

int main()
{
	// Problem #33

	string S7 = ReadString();

	cout << "\nNumber of vowels is: " << CountVowels(S7);

	system("pause>0");
}
```

Write a program to read a string then Count all Vowels in that String
(Vowel are : a , e , I , o , u)

? Pleas Enter your string

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Programming Advices

Number of vowels is: 14

#Problem 34 : Print All Vowels In String

```
#include <iostream>
#include <string>
#include <iomanip>

using namespace std;

// Problem #23

string ReadString()
{
	string S1 = " ";

	cout << "Pleas Enter your string ? \n";
	getline(cin, S1);

	return S1;

}

// Problem #32

bool IsVowel(char Ch4)
{
	Ch4 = tolower(Ch4);

	return ((Ch4 == 'a') ||(Ch4 == 'e') ||(Ch4
== 'i') ||(Ch4 == 'o') ||(Ch4 == 'u')) ;


}

// Problem #34

void PrintVowels(string S8)
{
	cout << "\nVowels in string are : ";

	for (short i = 0; i < S8.length(); i++)
	{
		if (IsVowel(S8[i]))
		{
			cout << S8[i] << "   ";
		}
	}
}

int main()
{
	// Problem #34

	string S8 = ReadString();

	PrintVowels(S8);

	system("pause>0");
}
```

Write a program to read a string then Print all Vowels in that String
(Vowel are : a , e , I , o , u)

? Pleas Enter your string

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Programming Advices

Vowels in string are :
o a e A u a o u o a i A i e

#Problem 35 : Print Each Word In String

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

// Problem #23

string ReadString()
{
	string S1 = " ";

	cout << "Pleas Enter your string ? \n";
	getline(cin, S1);

	return S1;
}

// Problem #35

void PrintEachWordInString(string S9)
{
	string delim = " "; // Delimiter

	cout << "\nYour string words are : \n\n";
	short pos = 0;
	string sWord; // define a string variable

	// use fine() function to get the position
of the delimiters
	while ((pos = S9.find(delim)) !=
std::string::npos)
	{
		// الفراغ - الحد ) اوجد   S9.find(delim)
		sWord = S9.substr(0, pos);

		if (sWord != "")
		{
			cout << sWord << endl;
		}
		// احذف من (0 الى عدد الأحرف + الحد
		// erase() until positon and move to next word
		S9.erase(0, pos + delim.length());
	}

	// طباعة الكلمة الأخيرة من النص
	if (S9 != "")
	{
		// it print last word of the string
		cout << S9 << endl;
	}
}

int main()
{
	// Problem #35

	PrintEachWordInString(ReadString());
	system("pause>0");
}
```

Write a program to read a string then Print Each Word in that String

? Pleas Enter your string

Mohammed Abu-Hadhoud
@ProgrammingAdvices

: Your string words are

Mohammed

Abu-Hadhoud

ProgrammingAdvices@

#Problem 36 : Count Each Word In String

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

// Problem #23
string ReadString()
{
	string S1 = " ";

	cout << "Pleas Enter your string ? \n";
	getline(cin, S1);
	return S1;
}

// Problem #36
short CountWords(string S9)
{
	string delim = " "; // Delimiter
	short Count = 0;
	short pos = 0;
	string sWord; // define a string variable

	// use fine() function to get the position
of the delimiters
	while ((pos = S9.find(delim)) !=
std::string::npos)
	{
		// الفراغ - الحد ) اوجد   S9.find(delim)
		sWord = S9.substr(0, pos);

		if (sWord != "")
		{
			Count++;
		}
		// احذف من (0 الى عدد الأحرف + الحد
		// erase() until positon and move to next word
		S9.erase(0, pos + delim.length());
	}

	// طباعة الكلمة الأخيرة من النص
	if (S9 != "")
	{
		// it print last word of the string
		Count++;
	}
	return Count;
}

int main()
{
	// Problem #36

	string S9 = ReadString();
	cout << "\nThe number of words in your string is: ";
	cout << CountWords(S9);

	system("pause>0");
}
```

Write a program to read a string then Count Each Word in that String

? Pleas Enter your string

Mohammed Abu-Hadhoud
@ProgrammingAdvices

The number of words in your string is: 3

#Problem 37 : Split String

```cpp
#include <iostream>
#include <string>
#include <iomanip>
#include <vector>

using namespace std;

// Problem #23
string ReadString()
{
	string S1 = " ";

	cout << "Pleas Enter your string ? \n";
	getline(cin, S1);
	return S1;
}

// Problem #37

vector <string> SplitString(string S9, string
Delim)
{
	vector <string> vString;

	short pos = 0;
	string sWord; // define a string variable

	// use fine() function to get the position
of the delimiters
	while ((pos = S9.find(Delim)) !=
std::string::npos)
	{
		// الفراغ - الحد ) اوجد   S9.find(delim)
		sWord = S9.substr(0, pos);


		if (sWord != "")
		{
			vString.push_back(sWord);
		}
		// الحد + الأحرف عدد الى 0) من احذف
		// erase() until positon and move to next word
		S9.erase(0, pos + Delim.length());
	}

	// طباعة الكلمة الأخيرة من النص
	if (S9 != "")
	{
		// it print last word of the string
		vString.push_back(S9);

	}
	return vString;

}
```

Write a program to read a string then make a function to Split Each Word in Vector

? Pleas Enter your string

Mohammed Abu-Hadhoud @ProgrammingAdvices

Tokens = 3

Mohammed

Abu-Hadhoud

ProgrammingAdvices@

```
int main()
{
	// Problem #37

vector <string> vString;

vString = SplitString(ReadString(), " ");
cout << "Tokens = " << vString.size() << endl;

for (string& s : vString)
{
	cout << s << endl;
}


	system("pause>0");
}
```

#Problem 38 : TrimLeft , TrimRight , Trim

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

// Problem #38

string TrimLeft(string S10)
{
	for (short i = 0; i < S10.length(); i++)
	{
		if (S10[i] != ' ')
		{
			return  S10.substr(i,
S10.length() - i);

		}
	}
	return "";

}

string TrimRight(string S10)
{
	for (short i = S10.length() - 1; i >= 0; i-
-)
	{
		if (S10[i] != ' ')
		{
			return  S10.substr(0, i + 1);

		}
	}
	return "";

}

string Trim(string S10)
{
	return TrimLeft(TrimRight(S10));

}


int main()
{
	// Problem #38

	string S10 = "     Mohammed Abu-Hadhoud     ";

	cout << "\nString      = " << S10;
	cout << "\n\nTrim Left   = " << TrimLeft(S10);
	cout << "\nTrim Right  = " << TrimRight(S10);
	cout << "\nTrim        = " << Trim(S10);



	system("pause>0");
}
```

Write a program to read a string TrimLeft , Right , All

String = Mohammed Abu-Hadhoud

Trim Left = Mohammed Abu-Hadhoud

Trim Right = Mohammed Abu-Hadhoud

Trim = Mohammed Abu-Hadhoud

#Problem 39 : Join String

```cpp
#include <iostream>
#include <string>
#include <iomanip>
#include <vector>
using namespace std;

// Problem #39

string JoinString(vector <string> vString, string
Delim)
{
	string S1 = "";

	for (string& s : vString)
	{
		S1 = S1 + s + Delim;
	}

	// حذف Delim الأخير
	return S1.substr(0, S1.length() - Delim.length());
}

int main()
{
	// Problem #39

	vector<string> vString2 = { "Mohammed","Faid","Ali","Maher" };

	cout << "\nVector after join: \n";
	cout << JoinString(vString2, "###");


	system("pause>0");
}
```

Write a program to join Vector of strings into a one string with separators

:Vector after join

Mohammed###Faid###Ali###Maher

#Problem 40 : Join String (Overloading)

```cpp
#include <iostream>
#include <string>
#include <iomanip>
#include <vector>
using namespace std;

// Problem #40

string JoinString(string arrString[], short
Length, string Delim)
{
	string S1 = "";

	for (short i = 0; i < Length; i++)
	{
		S1 = S1 + arrString[i] + Delim;
	}

	// حذف Delim الأخير
	return S1.substr(0, S1.length() - Delim.length());
}

int main()
{
	// Problem #40

	string arrString[] = { "Mohammed","Faid","Ali","Maher" };

	cout << "\n\nArray after join: \n";
	cout << JoinString(arrString, 4, "***");

	system("pause>0");
}
```

Write a program to join Array of strings into a one string with separators

:Array after join

Mohammed***Faid***Ali***Maher

#Problem 41 : Reverse Words

```
#include <iostream>
#include <string>
#include <iomanip>
#include <vector>
using namespace std;

// Problem #23

string ReadString()
{
	string S1 = " ";

	cout << "Pleas Enter your string ? \n";
	getline(cin, S1);

	return S1;

}
// Problem #37

vector <string> SplitString(string S9, string
Delim)
{
	vector <string> vString;

	short pos = 0;
	string sWord; // define a string variable

	// use fine() function to get the position of the delimiters
	while ((pos = S9.find(Delim)) != std::string::npos)
	{
		// الفراغ - الحد ) اوجد   S9.find(delim)
		sWord = S9.substr(0, pos);


		if (sWord != "")
		{
			vString.push_back(sWord);
		}
		// احذف من (0 الى عدد الأحرف + الحد
		// erase() until positon and move to next word
		S9.erase(0, pos + Delim.length());
	}

	// طباعة الكلمة الأخيرة من النص
	if (S9 != "")
	{
		// it print last word of the string
		vString.push_back(S9);

	}
	return vString;

}
```

Write a program to read string and reverse its word

? Pleas Enter your string

Mohammed Abu-Hadhoud
I'm From Jordan

String after reversing :words

Jordan From I'm Abu-Hadhoud Mohammed

```
// Problem #41

string ReverseWordsInString(string S11)
{
	vector<string> vString;
	string S2 = "";

	vString = SplitString(S11, " ");

	// declare iterator
	vector<string>::iterator iter = vString.end();

	// Pointer باستخدام Vector المرور على عناصر
	while (iter != vString.begin())
	{
		--iter;
		S2 += *iter + " ";
	}

	S2 = S2.substr(0, S2.length() - 1); //remove last space.

	return S2;
}

int main()
{
	// Problem #41

	string S11 = ReadString();
	cout << "\n\nString after reversing words:";
	cout << "\n" << ReverseWordsInString(S11);

	system("pause>0");
}
```

#Problem 42 : Replace Words

```cpp
#include <iostream>
#include <string>
#include <iomanip>
#include <vector>
using namespace std;

// Problem #42

string
ReplaceWordInStringUsingBuiltInFunction(string
S12, string StringToReplace, string sRepalceTo)
{
	// البحث عن الكلمة المراد تبديلها
	short pos = S12.find(StringToReplace);

	// هل الكلمة موجودة لا تساوي فراغ
	while (pos != std::string::npos)
	{
		//  طول + , 12 بدل الكلمة من طول مثلا
بالكلمة الجديدة ,  الكلمة
		S12 = S12.replace(pos,
StringToReplace.length(), sRepalceTo);

		// البحث عن الكلمة المراد تبديلها
		pos = S12.find(StringToReplace);
//find next
	}

	return S12;
}

int main()
{
	// Problem #42

	string S12 = "Welcome to Jordan , Jordan is a nice country";
	string StringToReplace = "Jordan";
	string ReplaceTo = "USA";

	cout << "\nOrigial String\n" << S12;
	cout << "\n\nString After Replace:";
	cout << "\n" << ReplaceWordInStringUsingBuiltInFunction(S12,
	StringToReplace, ReplaceTo);


	system("pause>0");
}
```

Write a program to Replace words in string :

Original String

Welcome to Jordan , Jordan is a nice country

:String After Replace

Welcome to USA , USA is a nice country

#Problem 43 : Replace Words (Custom)

```
#include <iostream>
#include <string>
#include <iomanip>
#include <vector>

using namespace std;

// Problem #26

string LowerAllString(string S3)
{

	for (int i = 0; i < S3.length(); i++)
	{
		S3[i] = tolower(S3[i]);
	}
	return S3;
}

// Problem #37

vector <string> SplitString(string S9, string
Delim)
{
	vector <string> vString;

	short pos = 0;
	string sWord; // define a string variable

	// use fine() function to get the position
of the delimiters
	while ((pos = S9.find(Delim)) !=
std::string::npos)
	{
		// الفراغ - الحد ) اوجد   S9.find(delim)
		sWord = S9.substr(0, pos);


		if (sWord != "")
		{
			vString.push_back(sWord);
		}
		// الحد + الأحرف عدد الى 0) من احذف
		// erase() until positon and move to next word
		S9.erase(0, pos + Delim.length());
	}

	// طباعة الكلمة الأخيرة من النص
	if (S9 != "")
	{
		// it print last word of the string
		vString.push_back(S9);

	}
	return vString;

}
```

Write a program to Replace words in string using Custom function :

Original String

Welcome to Jordan , Jordan is a nice country

: Replace with Match Case

Welcome to Jordan , Jordan is a nice country

Replace with don't Match : Case

Welcome to USA , USA is a nice country

```
// Problem #39

string JoinString(vector <string> vString, string Delim)
{
	string S1 = "";

	for (string& s : vString)
	{
		S1 = S1 + s + Delim;
	}

	// حذف Delim الأخير
	return S1.substr(0, S1.length() - Delim.length());
}

// Problem #43

string ReplaceWordInStringUsingSplit(string S13, string StringToReplace, string
sRepalceTo, bool MatchCase = true)
{
	vector <string> vString = SplitString(S13, " ");

	for (string& s : vString)
	{
		if (MatchCase)
		{
			if (s == StringToReplace)
			{
				s = sRepalceTo;
			}
		}
		else
		{
			if (LowerAllString(s) == LowerAllString(StringToReplace))
			{
				s = sRepalceTo;
			}
		}
	}
	return JoinString(vString, " ");
}

int main()
{
	// Problem #43

	string S13 = "Welcome to Jordan , Jordan is a nice country";
	string StringToReplace = "jordan";
	string ReplaceTo = "USA";

	cout << "\Original  String\n" << S13;

	cout << "\n\nReplace with Match Case :";
	cout << "\n" << ReplaceWordInStringUsingSplit(S13, StringToReplace,
ReplaceTo);

	cout << "\n\nReplace with don't Match Case :";
	cout << "\n" << ReplaceWordInStringUsingSplit(S13, StringToReplace,
ReplaceTo, false);

	system("pause>0");
}
```

#Problem 44 : Remove Punctuations

```
#include <iostream>
#include <string>
#include <iomanip>
#include <vector>

using namespace std;


// Problem #44

string RemovePunctuationsFromString(string S14)
{
	string S2 = "";

	for (short i = 0; i < S14.length(); i++)
	{
		if (!ispunct(S14[i]))
		{
			S2 += S14[i];
		}
	}

	return S2;
}

int main()
{
	// Problem 44

	string S14 = "Welcome to Jordan , Jordan is a nice country ; it's
amazing";

	cout << "\Original  String\n" << S14;
	cout << "\n\nPunctuations Removed : \n" <<
RemovePunctuationsFromString(S14);

	system("pause>0");
}
```

Write a program to Remove all Punctuations from a string

Original String

Welcome to Jordan , Jordan is a nice country ; it's amazing

: Punctuations Removed

Welcome to Jordan Jordan is a nice country its amazing

#Problem 45 : Convert Record to Line

```cpp
#include <iostream>
#include <string>
#include <iomanip>
#include <vector>

using namespace std;

// Problem #45

struct stClient
{
	string AccountNumber = "";
	string PinCode = "";
	string Name = "";
	string Phone = "";
	int AccountBalance = 0;

};

stClient ReadNewClient()
{
	stClient Client;

	cout << "Enter Account Number ? ";

	// Usage of std::ws will extract all the
whitespace character
	// whitespace  عند تكرار الإدخال – في بعض الأحيان
يتم تجاوز الإدخال لأنه قد يخزن
	getline(cin >> ws, Client.AccountNumber);

	cout << "Enter PinCode ? ";
	getline(cin, Client.PinCode);

	cout << "Enter Name ? ";
	getline(cin, Client.Name);

	cout << "Enter Phone ? ";
	getline(cin, Client.Phone);

	cout << "Enter Account Balance ? ";
	cin >> Client.AccountBalance;

	return Client;

}

string CounvertRecordToLine(stClient Client, string Separator = "#//#")
{
	string stClientRecord = "";

	stClientRecord += Client.AccountNumber + Separator;
	stClientRecord += Client.PinCode + Separator;
	stClientRecord += Client.Name + Separator;
	stClientRecord += Client.Phone + Separator;
	stClientRecord += to_string(Client.AccountBalance);

	return stClientRecord;
}
```

Write a program to read Bank client Data Record and Convert it to one line :

: Please Enter Client Data

Enter Account Number ? A150

Enter PinCode ? 1234

Enter Name ? Mohammed Abu-Hadhoud

Enter Phone ? 079939999

Enter Account Balance ? 5000

:Client Record for Saving is

A150#//#1234#//#Mohammed Abu-Hadhoud#//#079939999#//#5000

```
int main()
{
	// Problem #45

	cout << "\nPlease Enter Client Data : \n\n";

	stClient Client;
	Client = ReadNewClient();

	cout << "\n\nClient Record for Saving is: \n";
	cout << CounvertRecordToLine(Client);


	system("pause>0");
}
```

#Problem 46 : Convert Line Data to Record

```
#include <iostream>
#include <string>
#include <iomanip>
#include <vector>

using namespace std;

// Problem #45

struct stClient
{
	string AccountNumber = "";
	string PinCode = "";
	string Name = "";
	string Phone = "";
	int AccountBalance = 0;

};

// Problem #37

vector <string> SplitString(string S9, string
Delim)
{
	vector <string> vString;

	short pos = 0;
	string sWord; // define a string variable

	// use fine() function to get the position
of the delimiters
	while ((pos = S9.find(Delim)) !=
std::string::npos)
	{
		// الفراغ - الحد ) اوجد   S9.find(delim)
		sWord = S9.substr(0, pos);


		if (sWord != "")
		{
			vString.push_back(sWord);
		}
		// الحد + الأحرف عدد الى 0) من احذف
		// erase() until positon and move to
next word
		S9.erase(0, pos + Delim.length());
	}

	// طباعة الكلمة الأخيرة من النص
	if (S9 != "")
	{
		// it print last word of the string
		vString.push_back(S9);

	}
	return vString;

}
```

Write a program to Convert line data to record and print it :

: Line Record is

A150#//#1234#//#Mohammed Abu-Hadhoud#//#079999#//#5270.00000

The following is the : extracted client record

Account Number : A150

PinCode : 1234

Name : Mohammed Abu-Hadhoud

Phone : 079999

Account Balance : 5270

```
// Problem #46

stClient CounvertLineToRecord(string Line, string Separator = "#//#")
{
	stClient Client;
	vector <string> vClientData;

	vClientData = SplitString(Line, Separator);

	Client.AccountNumber = vClientData[0];
	Client.PinCode = vClientData[1];
	Client.Name = vClientData[2];
	Client.Phone = vClientData[3];
	Client.AccountBalance = stod(vClientData[4]); // case string to double

	return Client;

}

void PrintClientRecord(stClient Client)
{
	cout << "\n\nThe following is the extracted client record : \n\n";

	cout << "Account Number  : " << Client.AccountNumber << endl;
	cout << "PinCode         : " << Client.PinCode << endl;
	cout << "Name            : " << Client.Name << endl;
	cout << "Phone           : " << Client.Phone << endl;
	cout << "Account Balance : " << Client.AccountBalance << endl;
}

int main()
{
	// Problem #46

	string stLine = "A150#//#1234#//#Mohammed Abu-
Hadhoud#//#079999#//#5270.00000";
	cout << "\nLine Record is : \n";
	cout << stLine << endl;

	stClient Client = CounvertLineToRecord(stLine);

	PrintClientRecord(Client);

	system("pause>0");
}
```

#Problem 47 : Add Clients to File

```cpp
#include <iostream>
#include <string>
#include <iomanip>
#include <vector>
#include <fstream>

using namespace std;

// Problem #45
struct stClient
{
	string AccountNumber = "";
	string PinCode = "";
	string Name = "";
	string Phone = "";
	int AccountBalance = 0;

};

stClient ReadNewClient()
{
	stClient Client;

	cout << "Enter Account Number ? ";

	// Usage of std::ws will extract all the whitespace character
	// whitespace عند تكرار الإدخال – في بعض الأحيان يتم تجاوز الإدخال لأنه قد يخزن
	getline(cin >> ws, Client.AccountNumber);

	cout << "Enter PinCode ? ";
	getline(cin, Client.PinCode);

	cout << "Enter Name ? ";
	getline(cin, Client.Name);

	cout << "Enter Phone ? ";
	getline(cin, Client.Phone);

	cout << "Enter Account Balance ? ";
	cin >> Client.AccountBalance;

	return Client;

}
string CounvertRecordToLine(stClient Client, string Separator = "#//#")
{
	string stClientRecord = "";

	stClientRecord += Client.AccountNumber + Separator;
	stClientRecord += Client.PinCode + Separator;
	stClientRecord += Client.Name + Separator;
	stClientRecord += Client.Phone + Separator;
	stClientRecord += to_string(Client.AccountBalance);

	return stClientRecord;

}
```

Write a program to ask you to enter clients and save them to File :

: Adding New Client

Enter Account Number ? A150

Enter PinCode ? 1234

Enter Name ? Mohammed Abu-Hadhoud

Enter Phone ? 09389838

Enter Account Balance ? 9000

Client Added Successfully , do you want to add more clients ? n

```
// Problem #47

const string ClientsFileName = "Clients.txt";

void AddDataLineToFile(string FileName, string strDataLine)
{
	fstream MyFile;
	char Revision = 'y';

	MyFile.open(FileName, ios::out | ios::app);

	if (MyFile.is_open())
	{
		MyFile << strDataLine << endl;
		MyFile.close();
	}
}

void AddNewClient()
{
	stClient Client;
	Client = ReadNewClient();

	AddDataLineToFile(ClientsFileName, CounvertRecordToLine(Client));
}

void AddClients()
{
	char AddMore = 'Y';

	do
	{
		system("cls");
		cout << "Adding New Client : \n\n";
		AddNewClient();

		cout << "\nClient Added Successfully , do you want to add more
clients ? ";
		cin >> AddMore;

	} while (toupper(AddMore) == 'Y');

}

int main()
{
	// Problem #47

	AddClients();


	system("pause>0");
}
```

#Problem 48 : Show All Clients

Write a program to Clients File and Show them on the Screen as follows

.Client List (5) Client(s)

```
-----------------------------------------------------------------------------------------

Account Number  | Pin Code  | Client Name            | Phone      | Balance |
-----------------------------------------------------------------------------------------
A150        | 1234     | Mohammed Abu-Hadhoud    | 09389838 | 9000      |
A151        | 1234     | Ali Maher               | 9349939  | 15000     |
A152        | 1234     | Fadi Jamil              | 9383838  | 1000      |
A153        | 1234     | Khalid Ibrahim          | 44435    | 400       |
A154        | 1234     | Mohsen Omar             | 55555    | 2000      |
-----------------------------------------------------------------------------------------
```

```cpp
#include <iostream>
#include <string>
#include <iomanip>
#include <vector>
#include <fstream>

using namespace std;

// Problem #47

const string ClientsFileName = "Clients.txt";

// Problem #45

struct stClinet
{
	string AccountNumber = "";
	string PinCode = "";
	string Name = "";
	string Phone = "";
	int AccountBalance = 0;

};

// Problem #37

vector <string> SplitString(string S9, string Delim)
{
	vector <string> vString;

	short pos = 0;
	string sWord; // define a string variable

	// use fine() function to get the position of the delimiters
	while ((pos = S9.find(Delim)) != std::string::npos)
	{
		// الفراغ - الحد ) اوجد   S9.find(delim)
		sWord = S9.substr(0, pos);


		if (sWord != "")
		{
			vString.push_back(sWord);
		}
		// احذف من (0 الى عدد الأحرف + الحد
		// erase() until positon and move to next word
		S9.erase(0, pos + Delim.length());
	}

	// طباعة الكلمة الأخيرة من النص
	if (S9 != "")
	{
		// it print last word of the string
		vString.push_back(S9);

	}
	return vString;

}
```

```
// Problem #46

stClinet CounvertLineToRecord(string Line, string Separator = "#//#")
{
	stClinet Clinet;
	vector <string> vClinetData;

	vClinetData = SplitString(Line, Separator);

	Clinet.AccountNumber = vClinetData[0];
	Clinet.PinCode = vClinetData[1];
	Clinet.Name = vClinetData[2];
	Clinet.Phone = vClinetData[3];
	Clinet.AccountBalance = stod(vClinetData[4]); // case string to double

	return Clinet;

}

// Problem #48

vector <stClinet> LoadClientsDataFromFile(string FileName)
{
	vector <stClinet> vClient;

	fstream MyFile;

	MyFile.open(FileName, ios::in);

	if (MyFile.is_open())
	{
		string Line;
		stClinet Clinet;

		while (getline(MyFile, Line))
		{
			Clinet = CounvertLineToRecord(Line);

			vClient.push_back(Clinet);
		}
		MyFile.close();
	}

	return vClient;
}

void PrintClientRecord(stClinet Client)
{
	cout << "| " << left << setw(15) << Client.AccountNumber;
	cout << "| " << left << setw(10) << Client.PinCode;
	cout << "| " << left << setw(30) << Client.Name;
	cout << "| " << left << setw(12) << Client.Phone;
	cout << "| " << left << setw(12) << Client.AccountBalance;

}
```

```
void PrintAllClientsData(vector <stClinet> vClients)
{
	cout << "\n\t\t\t\t\t Client List (" << vClients.size() << ")  Client(s).
";
	cout << "\n-----------------------------------------------------------";
	cout << "---------------------------------------\n" << endl;

	cout << "| " << left << setw(15) << "Account Number";
	cout << "| " << left << setw(10) << "Pin Code ";
	cout << "| " << left << setw(30) << "Client Name";
	cout << "| " << left << setw(12) << "Phone ";
	cout << "| " << left << setw(12) << "Balance ";

	cout << "\n-----------------------------------------------------------";
	cout << "---------------------------------------\n" << endl;

	for (stClinet Client : vClients)
	{
		PrintClientRecord(Client);

		cout << endl;
	}

	cout << "\n-----------------------------------------------------------";
	cout << "---------------------------------------\n" << endl;
}

int main()
{
	// Problem #48

	vector <stClinet> vClient = LoadClientsDataFromFile(ClientsFileName);

	PrintAllClientsData(vClient);

	system("pause>0");
}
```

#Problem 49 : Find Client By Account Number

```
#include <iostream>;
#include <iomanip>;
#include <string>
#include <vector>
#include <fstream>

using namespace std;

// Problem #37

vector <string> SplitString(string S9,
string Delim)
{
	vector <string> vString;

	short pos = 0;
	string sWord; // define a string
variable

	// use fine() function to get the
position of the delimiters
	while ((pos = S9.find(Delim)) !=
std::string::npos)
	{
		// الفراغ - الحد ) اوجد
S9.find(delim)
		sWord = S9.substr(0, pos);


		if (sWord != "")
		{

	vString.push_back(sWord);
		}
		//  + احذف من (0 الى عدد الأحرف
الحد
		// erase() until positon and
move to next word
		S9.erase(0, pos +
Delim.length());
	}

	// طباعة الكلمة الأخيرة من النص
	if (S9 != "")
	{
		// it print last word of the string
		vString.push_back(S9);

	}
	return vString;

}
```

Write a program to Find clint by Account Number and print it to the screen :

Please enter AccountNumber ?
B33

Client with Account Number (B33) !NOT Found

Please enter AccountNumber ?
A150

The following is the extracted : client record

Account Number : A150

PinCode : 1234

Name : Mohammed Abu-Hadhoud

Phone : 09389838

Account Balance : 9000

```
// Problem #45
struct stClient
{
	string AccountNumber = "";
	string PinCode = "";
	string Name = "";
	string Phone = "";
	int AccountBalance = 0;
};

// Problem #46
stClient CounvertLineToRecord(string Line, string Separator = "#//#")
{
	stClient Client;
	vector <string> vClientData;

	vClientData = SplitString(Line, Separator);

	Client.AccountNumber = vClientData[0];
	Client.PinCode = vClientData[1];
	Client.Name = vClientData[2];
	Client.Phone = vClientData[3];
	Client.AccountBalance = stod(vClientData[4]); // case string to double

	return Client;
}

void PrintClinetRecord(stClient Clinet)
{
	cout << "\n\nThe following is the extracted client record : \n\n";

	cout << "Account Number  : " << Clinet.AccountNumber << endl;
	cout << "PinCode         : " << Clinet.PinCode << endl;
	cout << "Name            : " << Clinet.Name << endl;
	cout << "Phone           : " << Clinet.Phone << endl;
	cout << "Account Balance : " << Clinet.AccountBalance << endl;
}

// Problem #48

vector <stClient> LoadClientsDataFromFile(string FileName)
{
	vector <stClient> vClient;

	fstream MyFile;

	MyFile.open(FileName, ios::in);

	if (MyFile.is_open())
	{
		string Line;
		stClient Clinet;

		while (getline(MyFile, Line))
		{
			Clinet = CounvertLineToRecord(Line);
			vClient.push_back(Clinet);
		}

		MyFile.close();
	}
	return vClient;
}
```

```
// Problem #49

const string ClientsFileName = "Clients.txt";

bool FindClientByAccountNumber(string AccountNumber, stClient& Client)
{
	vector <stClient> vClients = LoadClientsDataFromFile(ClientsFileName);

	for (stClient C : vClients)
	{
		if (C.AccountNumber == AccountNumber)
		{
			Client = C;
			return true;
		}
	}
	return false;
}

string ReadClientAccountNumber()
{
	string AccountNumber = "";

	cout << "\nPlease enter AccountNumber ? ";
	cin >> AccountNumber;

	return AccountNumber;
}

int main()
{
	// Problem #49

	stClient Client;
	string AccountNumber = ReadClientAccountNumber();

	if (FindClientByAccountNumber(AccountNumber, Client))
	{
		PrintClinetRecord(Client);
	}
	else
	{
		cout << "\nClient with Account Number (" << AccountNumber << ") is
NOT Found! \n";
	}

	system("pause>0");
}
```

#Problem 50 : Delete Client By Account Number

```
#include <iostream>;
#include <iomanip>;
#include <string>
#include <vector>
#include <fstream>

using namespace std;

// Problem #37

vector <string> SplitString(string S9,
string Delim)
{
	vector <string> vString;

	short pos = 0;
	string sWord; // define a string
variable

	// use fine() function to get the
position of the delimiters
	while ((pos = S9.find(Delim)) !=
std::string::npos)
	{
		// الفراغ - الحد ) اوجد
S9.find(delim)
		sWord = S9.substr(0, pos);


		if (sWord != "")
		{

	vString.push_back(sWord);
		}
		//  + الى عدد الأحرف 0) من احذف
الحد
		// erase() until positon and
move to next word
		S9.erase(0, pos +
Delim.length());
	}

	// طباعة الكلمة الأخيرة من النص
	if (S9 != "")
	{
		// it print last word of the
string
		vString.push_back(S9);

	}
	return vString;

}
```

Write a program to Delete clint by Account Number :

Please enter AccountNumber ?
B33

Client with Account Number (B33) !NOT Found

Please enter AccountNumber ?
A150

The following are the client Delete

Account Number : A150

PinCode : 1234

Name : Mohammed Abu-Hadhoud

Phone : 09389838

Account Balance : 9000

Are you sure you want delete client ? n/y ? y

.Client Deleted Successfully

```
// Problem #45

struct stClinet
{
	string AccountNumber = "";
	string PinCode = "";
	string Name = "";
	string Phone = "";
	double AccountBalance = 0;
	bool MarkForDelete = false;
};

string CounvertRecordToLine(stClinet Clinet, string Separator = "#//#")
{
	string stClinetRecord = "";

	stClinetRecord += Clinet.AccountNumber + Separator;
	stClinetRecord += Clinet.PinCode + Separator;
	stClinetRecord += Clinet.Name + Separator;
	stClinetRecord += Clinet.Phone + Separator;
	stClinetRecord += to_string(Clinet.AccountBalance);

	return stClinetRecord;

}

// Problem #46

stClinet CounvertLineToRecord(string Line, string Separator = "#//#")
{
	stClinet Clinet;
	vector <string> vClinetData;

	vClinetData = SplitString(Line, Separator);

	Clinet.AccountNumber = vClinetData[0];
	Clinet.PinCode = vClinetData[1];
	Clinet.Name = vClinetData[2];
	Clinet.Phone = vClinetData[3];
	Clinet.AccountBalance = stod(vClinetData[4]); // case string to double

	return Clinet;

}

void PrintClinetRecord(stClinet Clinet)
{
	cout << "\n\nThe following are the client Delete : \n\n";

	cout << "Account Number  : " << Clinet.AccountNumber << endl;
	cout << "PinCode         : " << Clinet.PinCode << endl;
	cout << "Name            : " << Clinet.Name << endl;
	cout << "Phone           : " << Clinet.Phone << endl;
	cout << "Account Balance : " << Clinet.AccountBalance << endl;
}

// Problem #47

const string ClientsFileName = "Clients.txt";
```

```
// Problem #48

vector <stClinet> LoadClientsDataFromFile(string FileName)
{
	vector <stClinet> vClient;

	fstream MyFile;

	MyFile.open(FileName, ios::in);

	if (MyFile.is_open())
	{
		string Line;
		stClinet Clinet;

		while (getline(MyFile, Line))
		{
			Clinet = CounvertLineToRecord(Line);

			vClient.push_back(Clinet);
		}
		MyFile.close();
	}

	return vClient;
}



// Problem #49

bool FindClientByAccountNumber(string AccountNumber, vector <stClinet> vClients,
stClinet& Client)
{
	for (stClinet C : vClients)
	{
		if (C.AccountNumber == AccountNumber)
		{
			Client = C;
			return true;
		}
	}
	return false;
}

string ReadClientAccountNumber()
{
	string AccountNumber = "";

	cout << "\nPlease enter AccountNumber ? ";
	cin >> AccountNumber;

	return AccountNumber;
}
```

```
// Problem #50

bool MarkClientForDeleteByAccountNumber(string AccountNumber, vector <stClinet>&
vClients)
{
	for (stClinet& C : vClients)
	{
		if (C.AccountNumber == AccountNumber)
		{
			C.MarkForDelete = true;
			return true;
		}
	}
	return false;
}
vector <stClinet> SaveClientsDataToFile(string FileName, vector <stClinet>
vClients)
{
	fstream MyFile;
	MyFile.open(FileName, ios::out); //overwrite

	string DataLine;
	if (MyFile.is_open())
	{
		for (stClinet C : vClients)
		{
			if (C.MarkForDelete == false)
			{
				// we only write record that are not marked for delete
				DataLine = CounvertRecordToLine(C);
				MyFile << DataLine << endl;
			}
		}
		MyFile.close();
	}
	return vClients;
}

bool DeleteClientByAccountNumber(string AccountNumber, vector <stClinet>&
vClients)
{
	stClinet Client;
	char Answer = 'n';

	if (FindClientByAccountNumber(AccountNumber, vClients, Client))
	{
		PrintClinetRecord(Client);

		cout << "\n\nAre you sure you want delete client ? n/y ?";
		cin >> Answer;

		if (Answer == 'y' || Answer == 'Y')
		{
			MarkClientForDeleteByAccountNumber(AccountNumber, vClients);
			SaveClientsDataToFile(ClientsFileName, vClients);

			vClients = LoadClientsDataFromFile(ClientsFileName);

			cout << "\n\n Client Deleted Successfully. \n";
			return true;
		}
	}
	else
```

```
	{
		cout << "\nClient with Account Number (" << AccountNumber << ") is
NOT Found! \n";
		return false;
	}


}


int main()
{

	// Problem #50

	vector <stClinet> vClients = LoadClientsDataFromFile(ClientsFileName);

	string AccountNumber = ReadClientAccountNumber();
	DeleteClientByAccountNumber(AccountNumber, vClients);


	system("pause>0");
}
```

#Problem 51 : Update Client By Account Number

```
#include <iostream>;
#include <iomanip>;
#include <string>
#include <vector>
#include <fstream>

using namespace std;

// Problem #37

vector <string> SplitString(string S9,
string Delim)
{
	vector <string> vString;

	short pos = 0;
	string sWord; // define a string
variable

	// use fine() function to get the
position of the delimiters
	while ((pos = S9.find(Delim)) !=
std::string::npos)
	{
		// الفراغ - الحد ) اوجد
S9.find(delim)
		sWord = S9.substr(0, pos);


		if (sWord != "")
		{

	vString.push_back(sWord);
		}
		//  + احذف من (0 الى عدد الأحرف
الحد
		// erase() until positon and
move to next word
		S9.erase(0, pos +
Delim.length());
	}

	// طباعة الكلمة الأخيرة من النص
	if (S9 != "")
	{
		// it print last word of the
string
		vString.push_back(S9);

	}
	return vString;

}
```

Write a program to Update clint by Account Number :

Please enter AccountNumber ? B33

Client with Account Number (B33) !NOT Found

Please enter AccountNumber ? A150

The following are the client Delete

Account Number : A150

PinCode : 1234

Name : Mohammed Abu-Hadhoud

Phone : 09389838

Account Balance : 9000

Are you sure you want Update client ? n/y ? y

Enter PinCode ? 4444

Enter Name ? Omar Hamed

Enter Phone ? 8177172

Enter Account Balance ? 4000

.Client Deleted Successfully

```cpp
// Problem #45

struct stClinet
{
	string AccountNumber = "";
	string PinCode = "";
	string Name = "";
	string Phone = "";
	double AccountBalance = 0;
	bool MarkForDelete = false;
};

string CounvertRecordToLine(stClinet Clinet, string Seperator = "#//#")
{
	string stClinetRecord = "";

	stClinetRecord += Clinet.AccountNumber + Seperator;
	stClinetRecord += Clinet.PinCode + Seperator;
	stClinetRecord += Clinet.Name + Seperator;
	stClinetRecord += Clinet.Phone + Seperator;
	stClinetRecord += to_string(Clinet.AccountBalance);

	return stClinetRecord;

}

// Problem #46

stClinet CounvertLineToRecord(string Line, string Seperator = "#//#")
{
	stClinet Clinet;
	vector <string> vClinetData;

	vClinetData = SplitString(Line, Seperator);

	Clinet.AccountNumber = vClinetData[0];
	Clinet.PinCode = vClinetData[1];
	Clinet.Name = vClinetData[2];
	Clinet.Phone = vClinetData[3];
	Clinet.AccountBalance = stod(vClinetData[4]); // case string to duoble

	return Clinet;

}

void PrintClinetRecord(stClinet Clinet)
{
	//cout << "\n\nThe following is the extracted client record : \n\n";
	cout << "\n\nThe following are the client Delete : \n\n";

	cout << "Account Number  : " << Clinet.AccountNumber << endl;
	cout << "PinCode         : " << Clinet.PinCode << endl;
	cout << "Name            : " << Clinet.Name << endl;
	cout << "Phone           : " << Clinet.Phone << endl;
	cout << "Account Balance : " << Clinet.AccountBalance << endl;
}

// Problem #47

const string ClientsFileName = "Clients.txt";
```

```
// Problem #48

vector <stClinet> LoadClientsDataFromFile(string FileName)
{
	vector <stClinet> vClient;

	fstream MyFile;

	MyFile.open(FileName, ios::in);

	if (MyFile.is_open())
	{
		string Line;
		stClinet Clinet;

		while (getline(MyFile, Line))
		{
			Clinet = CounvertLineToRecord(Line);

			vClient.push_back(Clinet);

		}

		MyFile.close();
	}

	return vClient;
}

// Problem #49

string ReadClientAccountNumber()
{
	string AccountNumber = "";

	cout << "\nPlease enter AccountNumber ? ";
	cin >> AccountNumber;

	return AccountNumber;
}

bool FindClientByAccountNumber(string AccountNumber, vector <stClinet> vClients,
stClinet& Client)
{
	//vector <stClinet> vClients = LoadClientsDataFromFile(ClientsFileName);

	for (stClinet C : vClients)
	{
		if (C.AccountNumber == AccountNumber)
		{
			Client = C;
			return true;
		}
	}
	return false;
}
```

```
// Problem #50

vector <stClinet> SaveClientsDataToFile(string FileName, vector <stClinet>
vClients)
{
	fstream MyFile;

	MyFile.open(FileName, ios::out); //overwrite

	string DataLine;
	if (MyFile.is_open())
	{

		for (stClinet C : vClients)
		{
			if (C.MarkForDelete == false)
			{
				// we only write record that are not marked for delete
				DataLine = CounvertRecordToLine(C);
				MyFile << DataLine << endl;
			}
		}
		MyFile.close();
	}
	return vClients;
}

// Problem #51

stClinet ChangeClientRecord(string AccountNumber)
{
	stClinet Client;

	Client.AccountNumber = AccountNumber;

	// Uasge of std::ws will extract allthe whitespace character
	// whitespace عند تكرار الإدخال – في بعض الأحيان يتم تجاوز الإدخال لأنه قد يخزن

	cout << "Enter PinCode ? ";
	getline(cin >> ws, Client.PinCode);

	cout << "Enter Name ? ";
	getline(cin, Client.Name);

	cout << "Enter Phone ? ";
	getline(cin, Client.Phone);

	cout << "Enter Account Balance ? ";
	cin >> Client.AccountBalance;

	return Client;

}
```

```
bool UpdateClientByAccountNumber(string AccountNumber, vector <stClinet>&
vClients)
{
	stClinet Client;
	char Answer = 'n';

	if (FindClientByAccountNumber(AccountNumber, vClients, Client))
	{
		PrintClinetRecord(Client);

		cout << "\n\nAre you sure you want Update client ? n/y ? ";
		cin >> Answer;

		if (Answer == 'y' || Answer == 'Y')
		{
			for (stClinet& C : vClients)
			{
				if (C.AccountNumber == AccountNumber)
				{
					C = ChangeClientRecord(AccountNumber);
					break;
				}
			}

			SaveClientsDataToFile(ClientsFileName, vClients);

			// Refresh Clients
			vClients = LoadClientsDataFromFile(ClientsFileName);

			cout << "\n\n Client Deleted Successfully. \n";
			return true;
		}
	}
	else
	{
		cout << "\nClient with Account Number (" << AccountNumber << ") is
NOT Found! \n";
		return false;
	}


}


int main()
{
	// Problem #51

	vector <stClinet> vClients = LoadClientsDataFromFile(ClientsFileName);

	string AccountNumber = ReadClientAccountNumber();
	UpdateClientByAccountNumber(AccountNumber, vClients);

	system("pause>0");
}
```