

2022년 IoT기반 스마트 솔루션 개발자 양성과정



Embedded Application

9-Graph in C#

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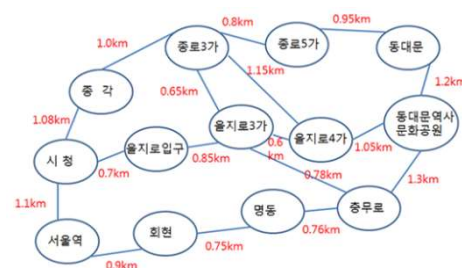
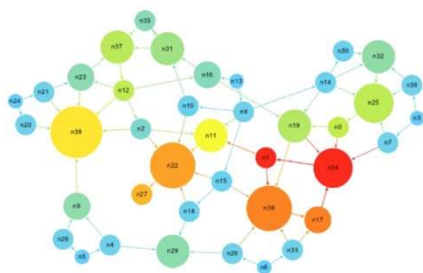
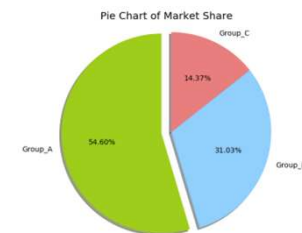
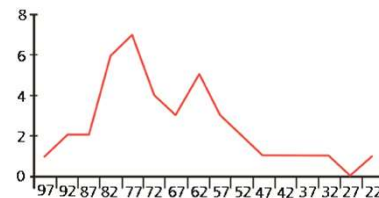
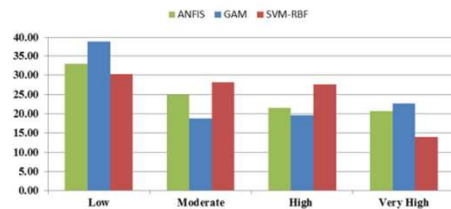
<https://cafe.naver.com/yoons2022>



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Graph

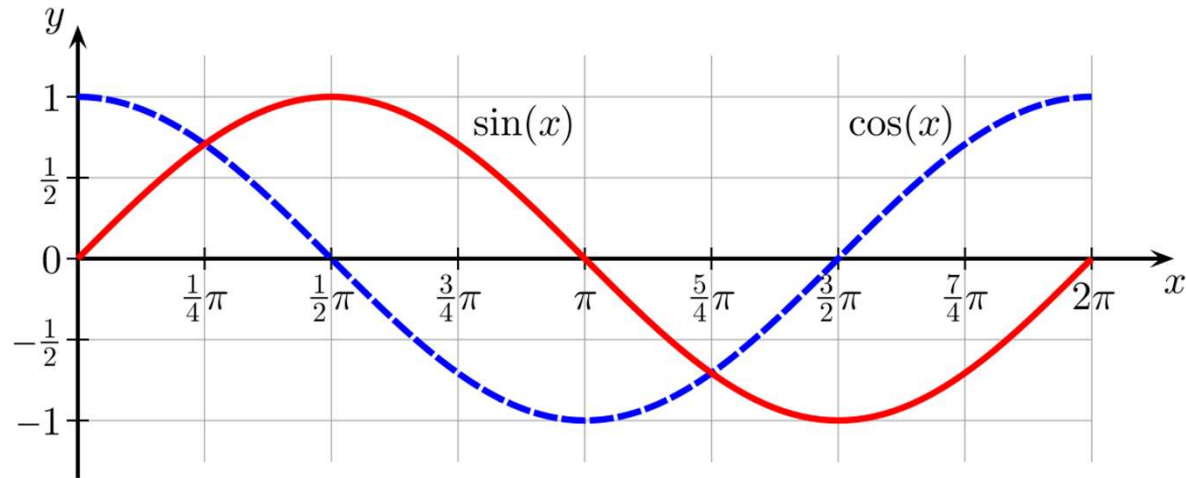
- 직선, 곡선, 도형, 다이어그램등을 이용하여 그래픽적 요소를 시각화한 차트
- 수량의 크기를 비교 : 막대그래프
- 변화 상태를 표시 : 꺾은선 그래프
- 데이터의 구성비를 표시 : 원 그래프
- 데이터간의 관계



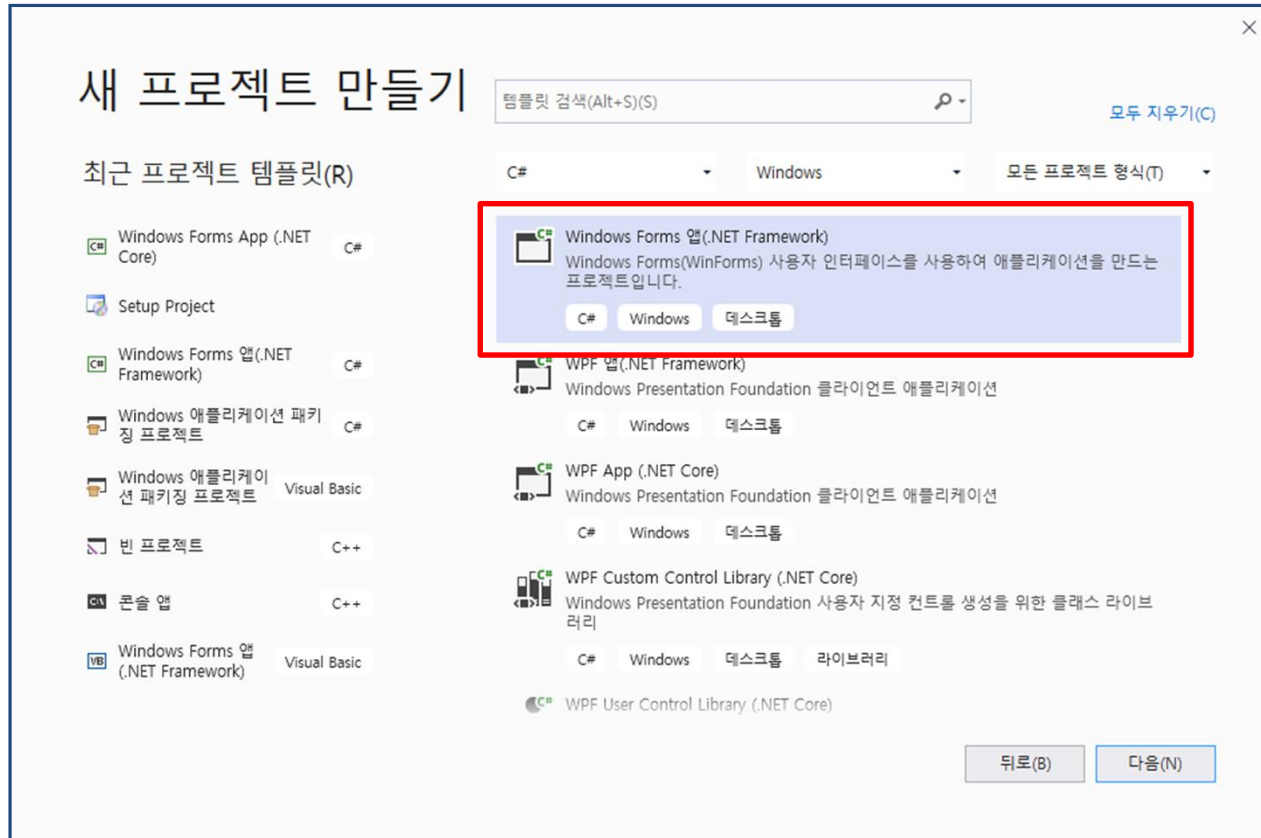
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삼각함수 Graph

- Sin Graph : $y=\sin(x)$
- Cos Graph : $y=\cos(x)$



C# Graph – 새 프로젝트



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새 프로젝트 구성

새 프로젝트 구성

Windows Forms 앱(.NET Framework) C# Windows 데스크톱

프로젝트 이름(N)
Graph

위치(L)
D:\AworkCom\학사업무\2020학사\충북대학교\lot Base SW Developer-2020\ProgramC\pg ...

솔루션 이름(M) ⓘ
Graph

☒ 솔루션 및 프로젝트를 같은 디렉터리에 배치(D)

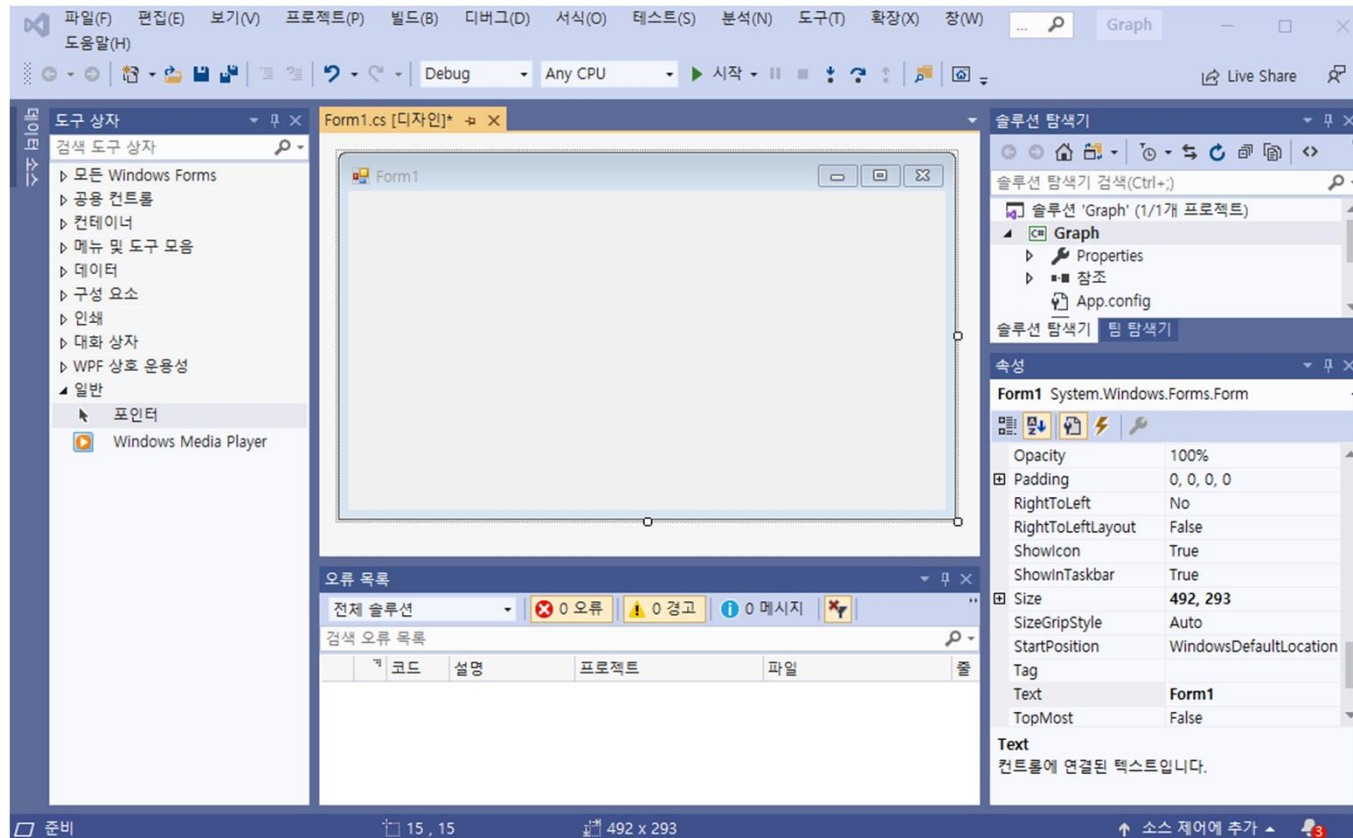
프레임워크(F)
.NET Framework 4.7.2

뒤로(B) 만들기(C)



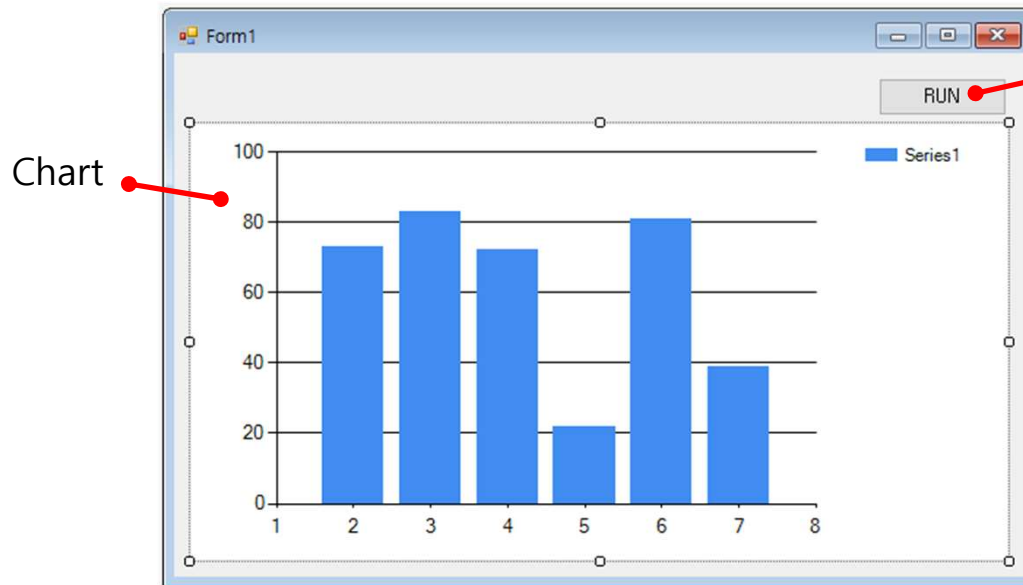
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새 프로젝트 시작



충북대학교 공동훈련센터

Form Design



Button

Components	Property	Value
Button1	(Name)	btnRun
	Text	Run



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Form1.cs

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Linq;
using System.Text;
using System.Threading.Tasks;
using System.Windows.Forms;

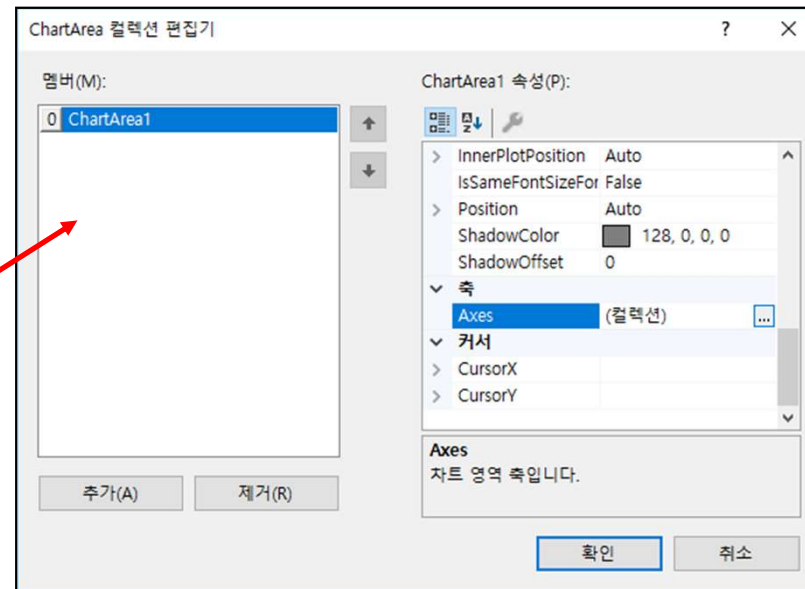
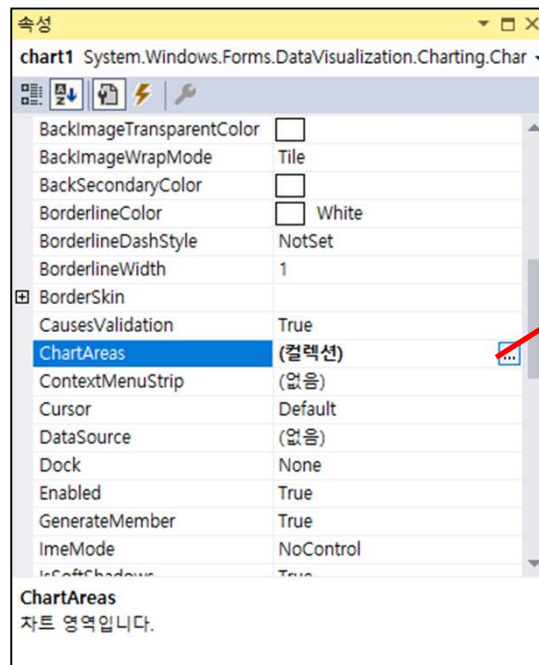
namespace Graph
{
    public partial class Form1 : Form
    {
        double SinValue;

        public Form1()
        {
            InitializeComponent();
        }

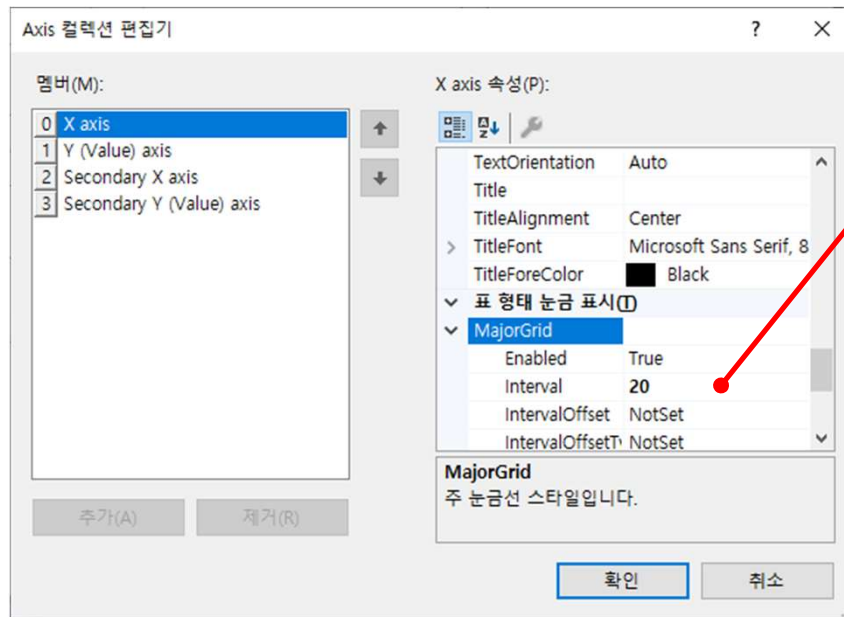
        private void Form1_Load(object sender, EventArgs e)
        {
            //
        }
    }
}
```



Chart Area Collection



X Axis Collection



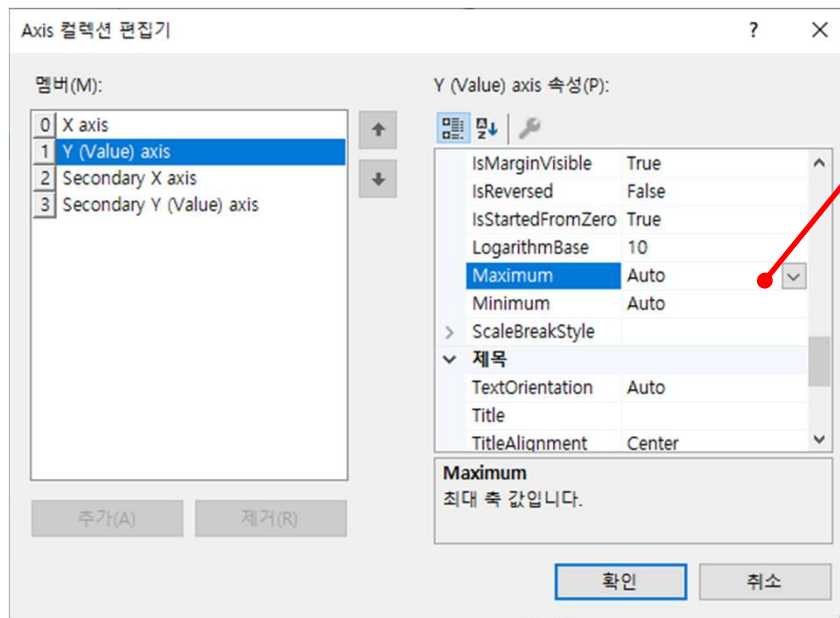
X axis : MajorGrid

Interval	20
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충북대학교 공동훈련센터

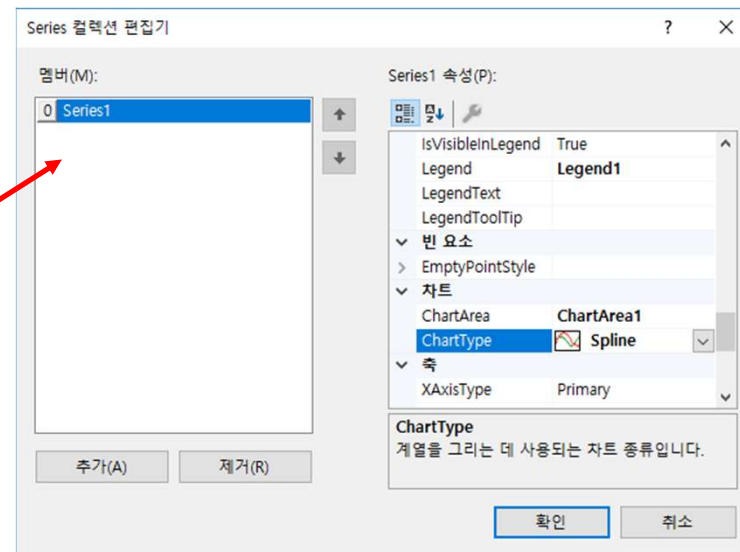
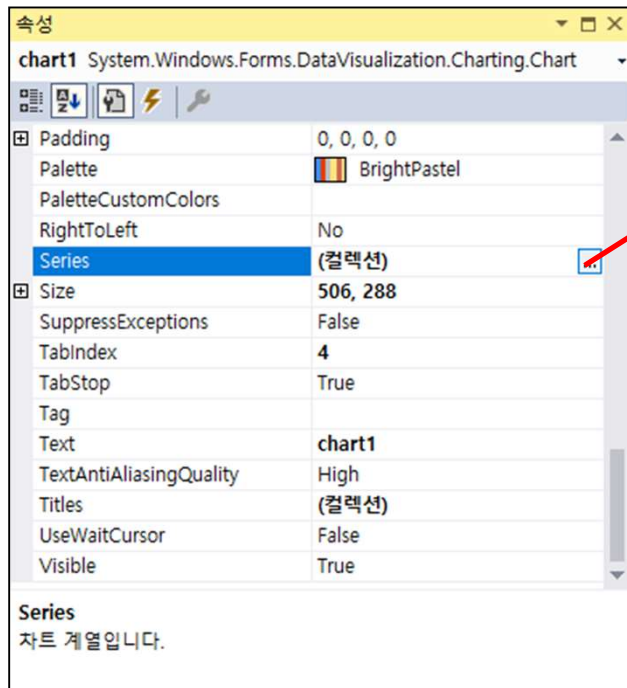
Y Axis Collection



Y (Value) axis	
Maximum	1
Minimum	-1



Series Collection



Series1	
ChartType	Spline
isVisibleInLegend	False



DataGeneration()

```
public partial class Form1 : Form
{
    double SinValue;

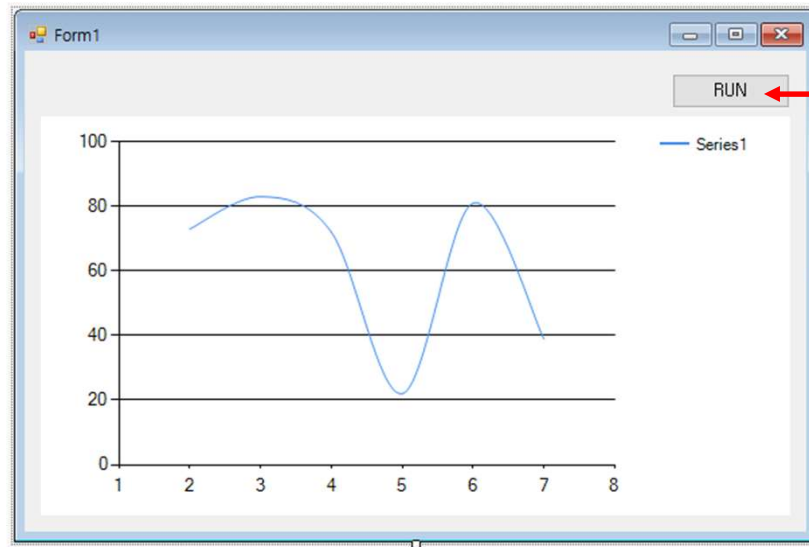
    public Form1()
    {
        InitializeComponent();
    }

    private void Form1_Load(object sender, EventArgs e)
    {
        //
    }

    private void DataGeneration()
    {
        for (int k = 0; k < 360; k++)
        {
            SinValue = Math.Sin(k * (3.141692 / 180));
            chart1.Series["Series1"].Points.Add(SinValue);
        }
    }
}
```



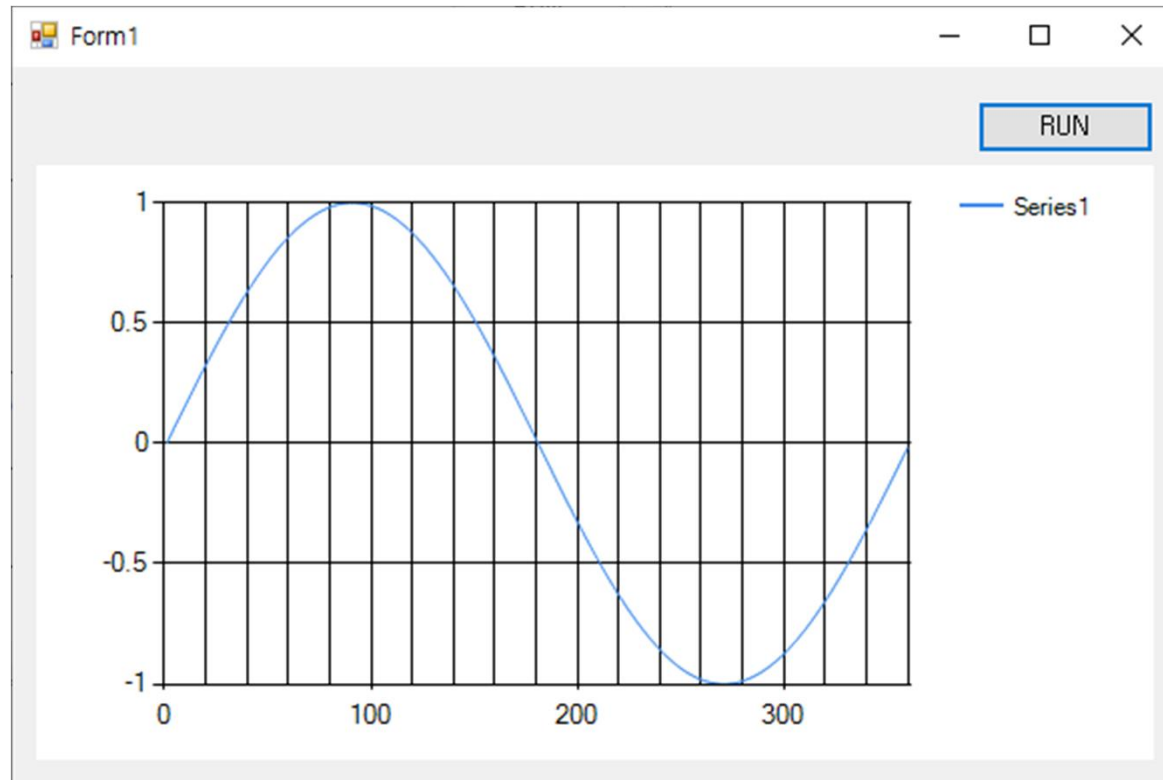
btnRun()_Click



```
private void btnRun_Click(object sender, EventArgs e)
{
    DataGeneration();
}
```

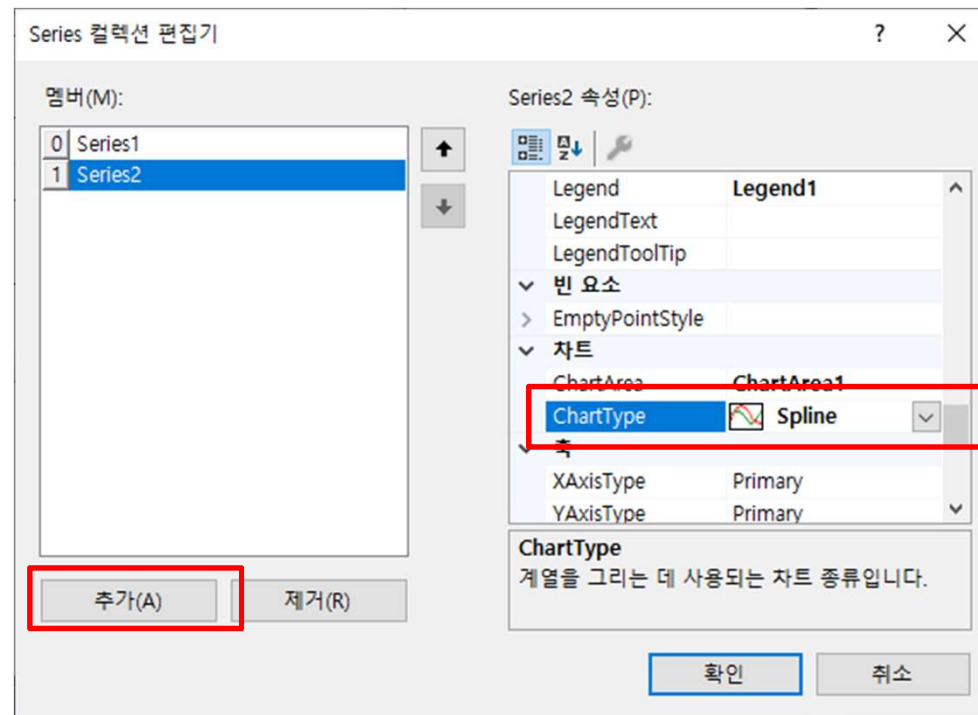


Build Run



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Append Cos()

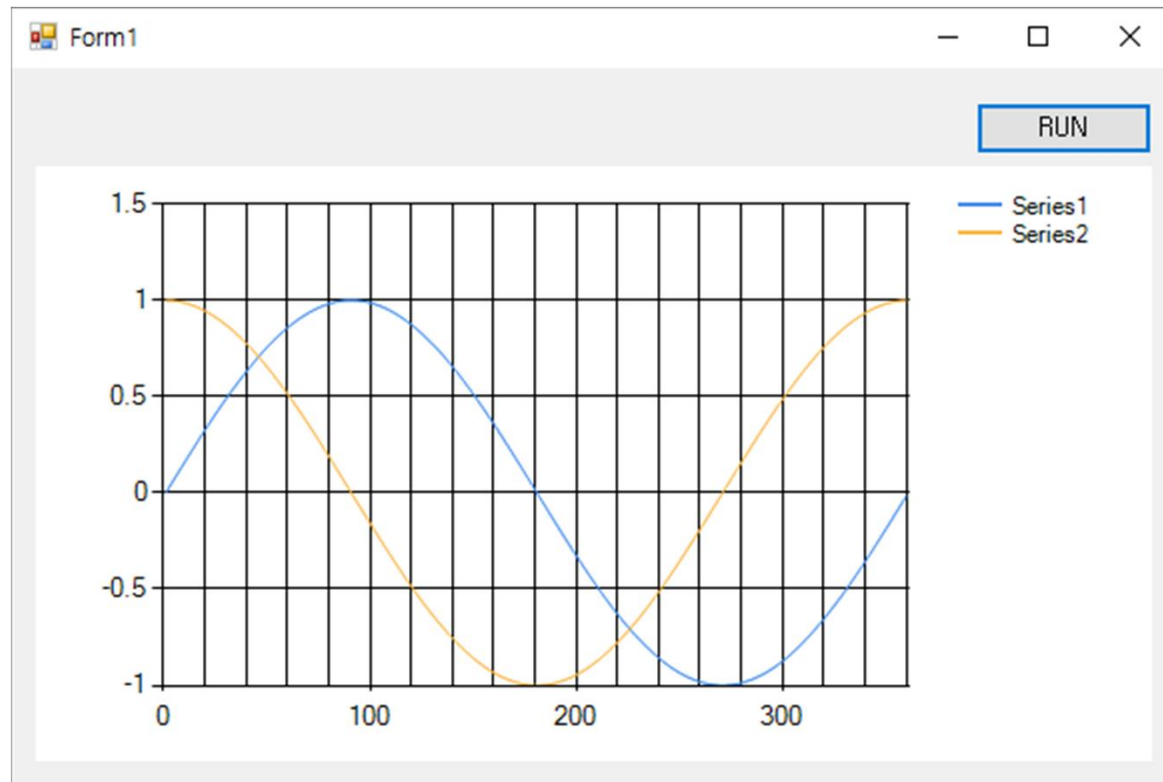


DataGeneration()

```
double SinValue;  
double CosValue;  
  
public Form1( ) [ ] ...  
  
private void Form1_Load(object sender, EventArgs e) [ ] ...  
  
private void DataGeneration()  
{  
    for (int k = 0; k < 360; k++)  
    {  
        SinValue = Math.Sin(k * (3.141692 / 180));  
        chart1.Series["Series1"].Points.Add(SinValue);  
  
        CosValue = Math.Cos(k * (3.141692 / 180));  
        chart1.Series["Series2"].Points.Add(CosValue);  
    }  
}  
  
private void btnRun_Click(object sender, EventArgs e) [ ] ...
```

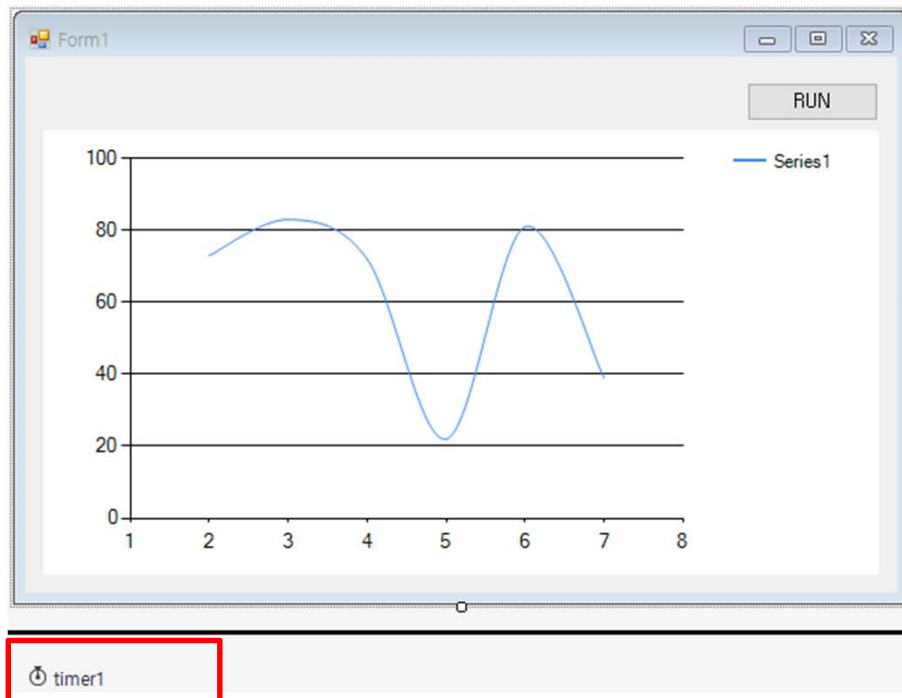


Build Run



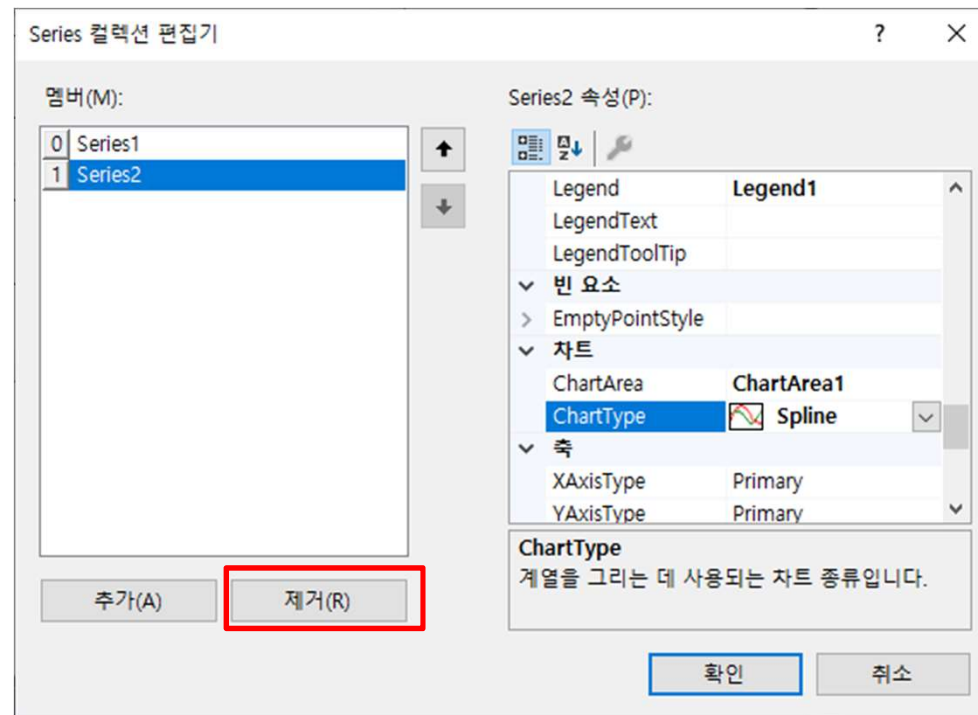
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Randon Graph

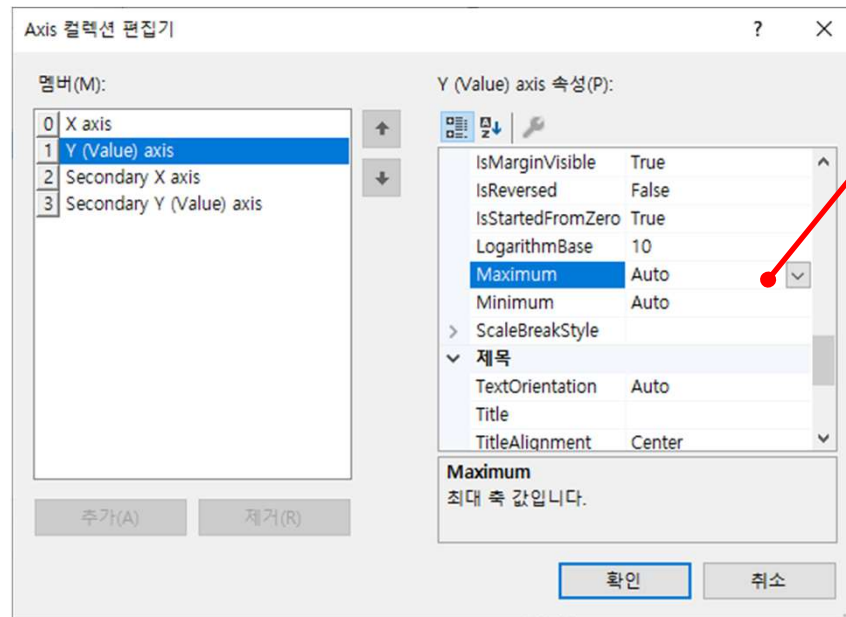


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Series2 Remove



Y Axis Collection



Y (Value) axis	
Maximum	100
Minimum	0



Code

```
double RndValue;
Random rnd = new Random( );

public Form1( ) [ ] ...

private void Form1_Load(object sender, EventArgs e)
{
    timer1.Interval = 1000;
    timer1.Stop( );
}

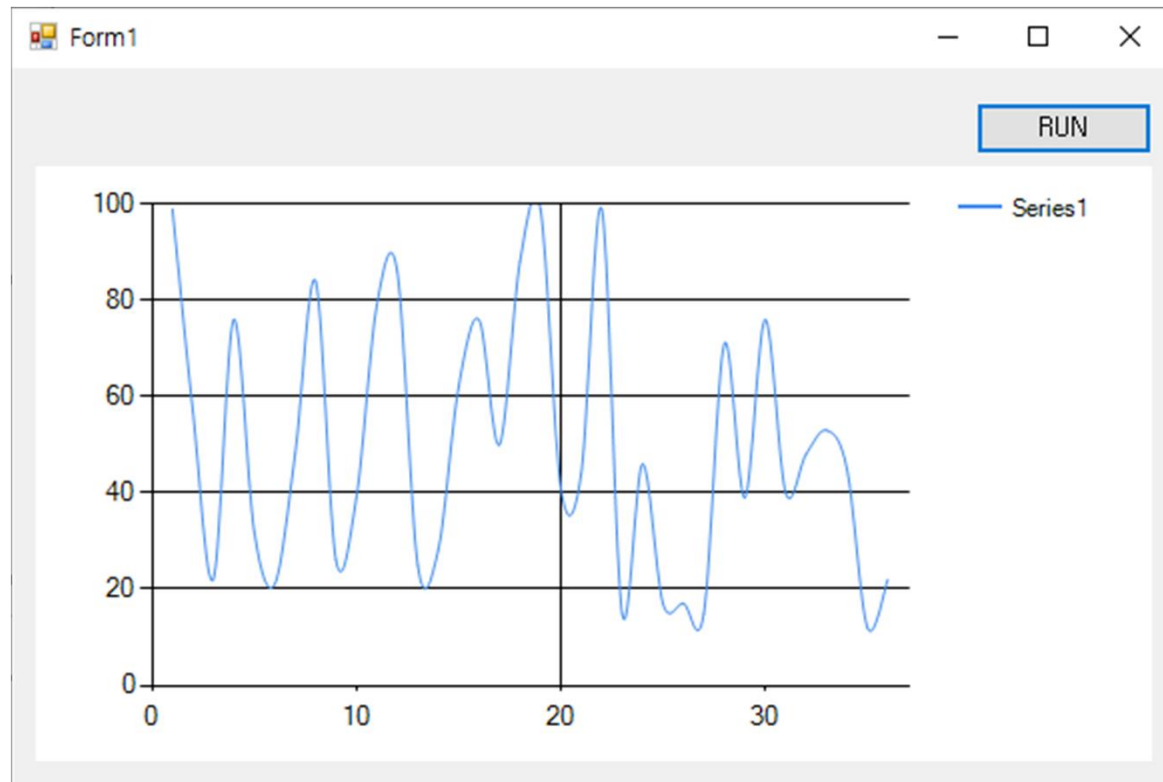
private void DataGeneration( )
{
    RndValue = rnd.Next(100);
    chart1.Series[ "Series1" ].Points.Add(RndValue);
}

private void timer1_Tick(object sender, EventArgs e)
{
    DataGeneration( );
}
```

```
private void btnRun_Click(object sender, EventArgs e)
{
    if (timer1.Enabled == true)
    {
        timer1.Stop( );
        btnRun.Text = "RUN";
    }
    else
    {
        btnRun.Text = "STOP";
        timer1.Start( );
    }
}
```



Build Run



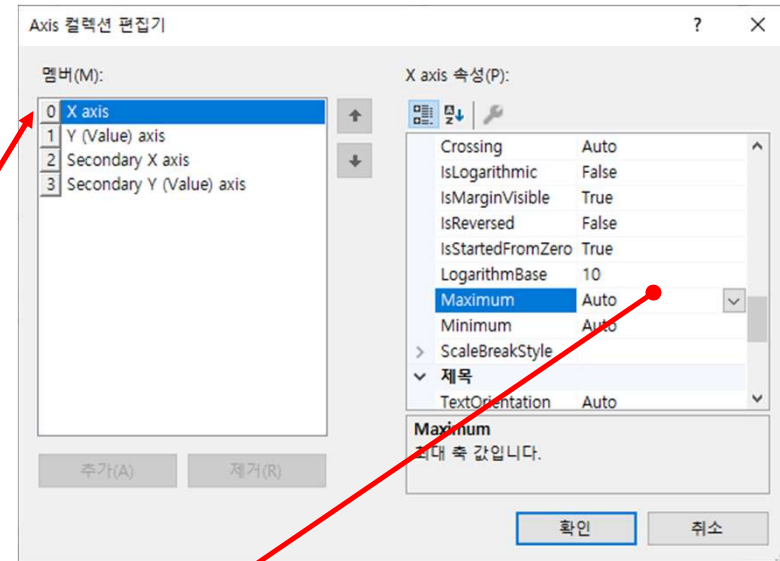
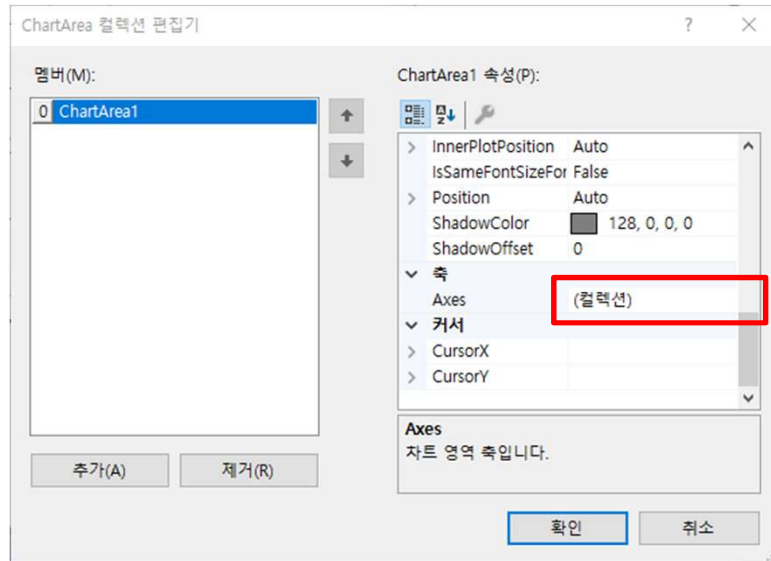
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Scope Display Methode

- 스트립 차트(Strip Chart)
 - 전체 데이터를 왼쪽으로 스크롤 후 새 데이터를 오른쪽에 표시함
 - 전자 계측기기 등
- 스코프 차트(Scope Chart)
 - 데이터를 오른쪽으로 이동하면서 표시 후 오른쪽 테두리에 닿으면 화면을 지우고 다시 왼쪽 부터 표시함
- 스위프 차트(Sweep Chart)
 - 데이터를 오른쪽으로 이동하면서 표시 후 오른쪽 테두리에 닿으면 다시 왼쪽 부터 표시함(화면 지움 없음, 수직선 표시)
 - 의료용 심전도계 등



X axis : Max/Min Value

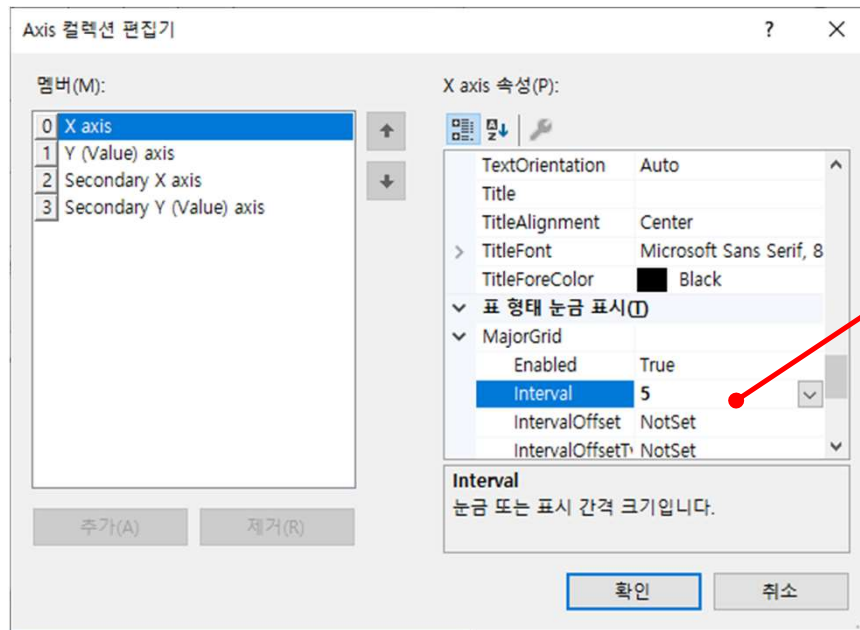


X axis	
Maximum	50
Minimum	0



충북대학교 공동훈련센터

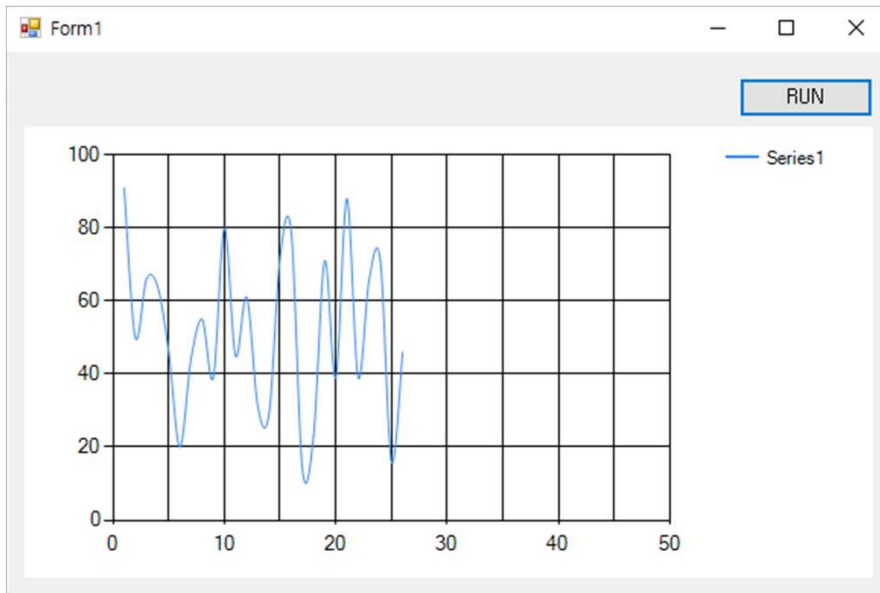
X axis MajorGrid



X axis	
Interval	5



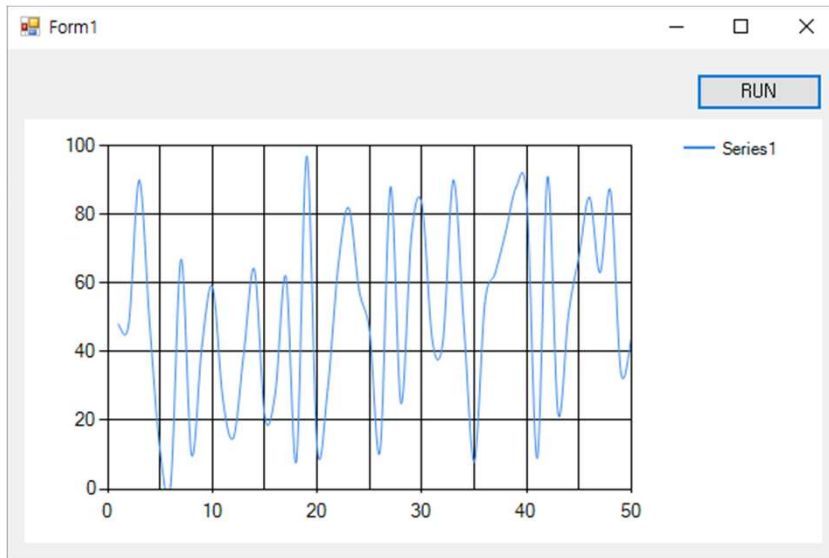
Scope Chart



```
private void DataGeneration()  
{  
    RndValue = rnd.Next(100);  
    chart1.Series["Series1"].Points.Add(RndValue);  
    if (chart1.Series["Series1"].Points.Count>50)  
    {  
        chart1.Series["Series1"].Points.Clear();  
    }  
}
```



Strip Chart



```
private void DataGeneration()
{
    RndValue = rnd.Next(100);
    chart1.Series["Series1"].Points.Add(RndValue);
    if (chart1.Series["Series1"].Points.Count>50)
    {
        chart1.Series["Series1"].Points.RemoveAt(0);
    }
}
```

