tutorial

Windows App SDK

Chessboard

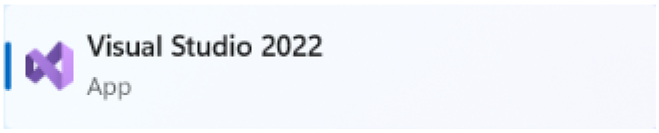
Chessboard

Chessboard shows how you can create a simple game of chess for two players using game assets and a toolkit from **NuGet** using the **Windows App SDK**.

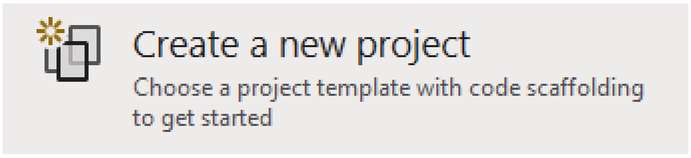
Step 1

Follow **Setup and Start** on how to get **Setup** and **Install** what you need for **Visual Studio 2022** and **Windows App SDK**.

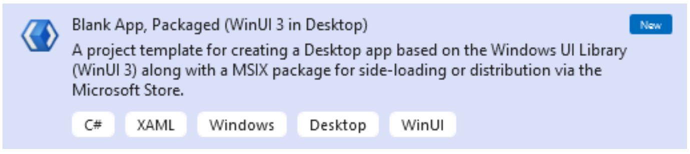
In **Windows 11** choose **Start** and then find or search for **Visual Studio 2022** and then select it.



Once **Visual Studio 2022** has started select **Create a new project**.


Create a new project
Choose a project template with code scaffolding to get started

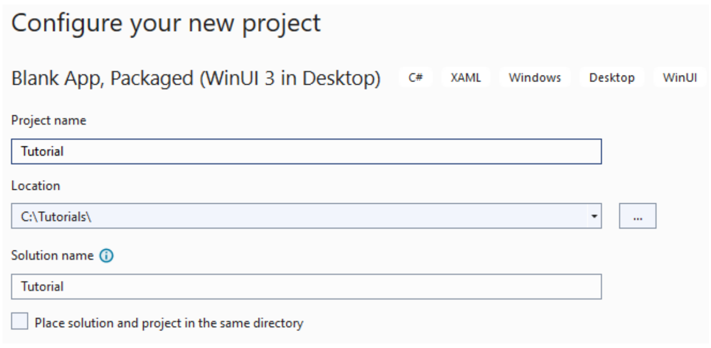
Then choose the **Blank App, Packages (WinUI in Desktop)** and then select **Next**.



Blank App, Packaged (WinUI 3 in Desktop) New

A project template for creating a Desktop app based on the Windows UI Library (WinUI 3) along with a MSIX package for side-loading or distribution via the Microsoft Store.

After that in **Configure your new project** type in the **Project name** as *Chessboard*, then select a Location and then select **Create** to start a new **Solution**.



Configure your new project

Blank App, Packaged (WinUI 3 in Desktop) C# XAML Windows Desktop WinUI

Project name: Tutorial

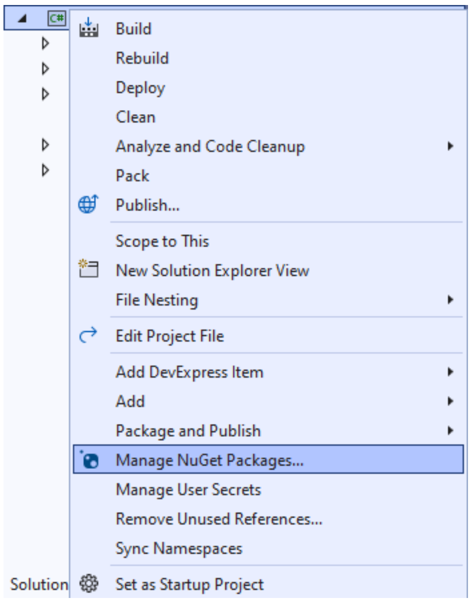
Location: C:\Tutorials\

Solution name: Tutorial

☐ Place solution and project in the same directory

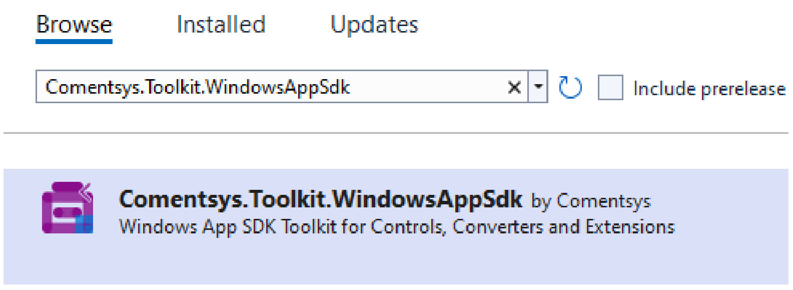
Step 2

Then in **Visual Studio** within **Solution Explorer** for the **Solution**, right click on the **Project** shown below the **Solution** and then select **Manage NuGet Packages...**



Step 3

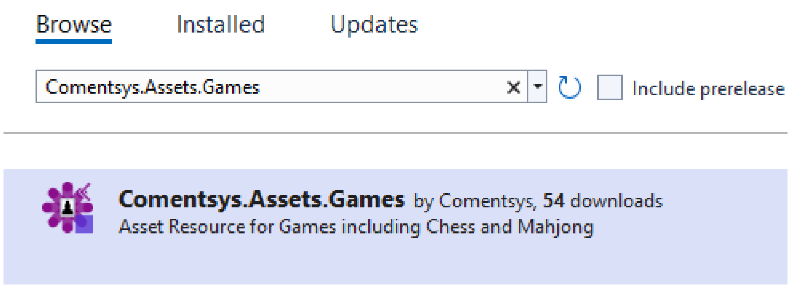
Then in the **NuGet Package Manager** from the **Browse** tab search for **Comentsys.Toolkit.WindowsAppSdk** and then select **Comentsys.Toolkit.WindowsAppSdk by Comentsys** as indicated and select **Install**


Browse
Installed
Updates
Comentsys.Toolkit.WindowsAppSdk
Include prerelease
Comentsys.Toolkit.WindowsAppSdk by Comentsys
Windows App SDK Toolkit for Controls, Converters and Extensions

This will add the package for **Comentsys.Toolkit.WindowsAppSdk** to your **Project**. If you get the **Preview Changes** screen saying **Visual Studio is about to make changes to this solution. Click OK to proceed with the changes listed below.** You can read the message and then select **OK** to **Install** the package.

Step 4

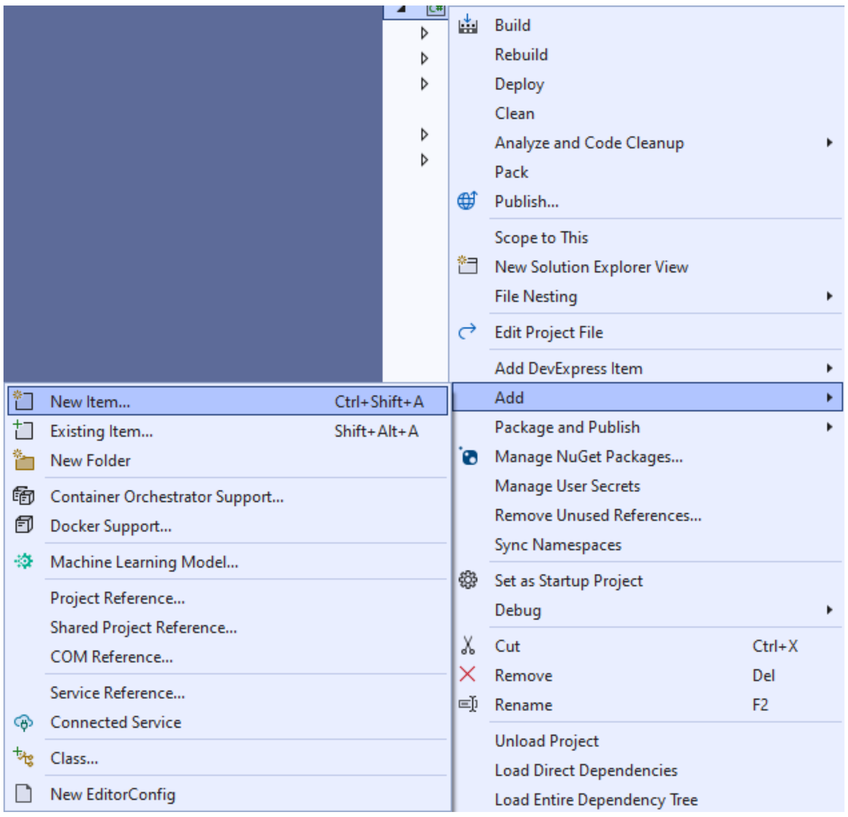
Then while still in the **NuGet Package Manager** from the **Browse** tab search for **Comentsys.Assets.Games** and then select **Comentsys.Assets.Games by Comentsys** as indicated and select **Install**


Browse
Installed
Updates
Comentsys.Assets.Games
Include prerelease
Comentsys.Assets.Games by Comentsys, 54 downloads
Asset Resource for Games including Chess and Mahjong

This will add the package for **Comentsys.Assets.Games** to your **Project**. If you get the **Preview Changes** screen saying **Visual Studio is about to make changes to this solution. Click OK to proceed with the changes listed below.** You can read the message and then select **OK** to **Install** the package, then you can close the **tab** for **Nuget: Chessboard** by selecting the **x** next to it.

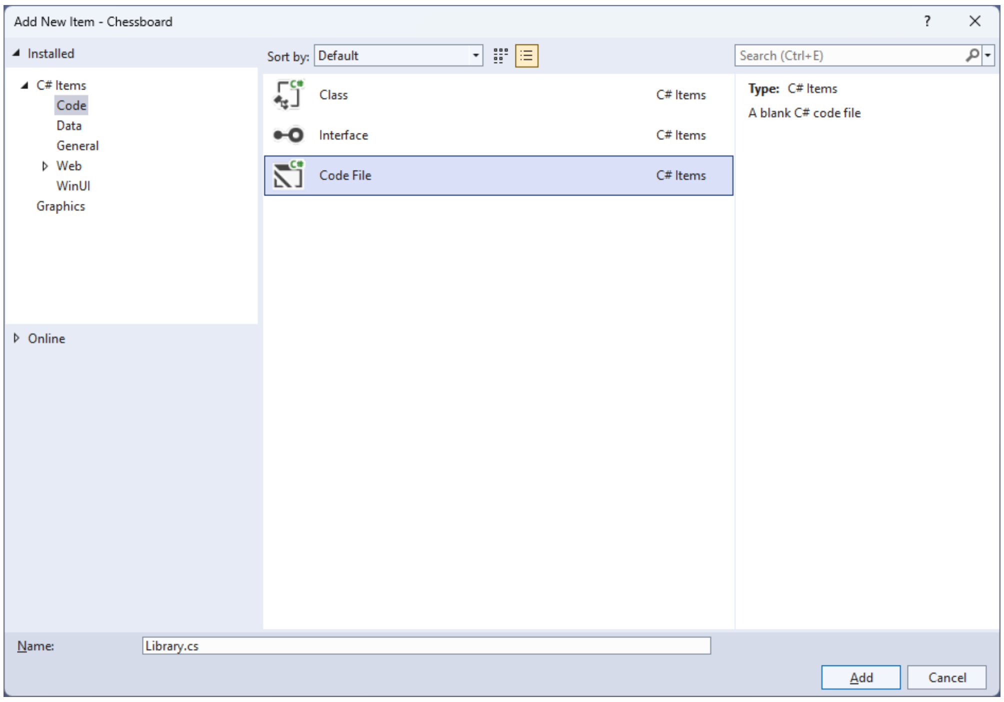
Step 5

Then in **Visual Studio** within **Solution Explorer** for the **Solution**, right click on the **Project** shown below the **Solution** and then select **Add** then **New Item...**



Step 6

Then in **Add New Item** from the **C# Items** list, select **Code** and then select **Code File** from the list next to this, then type in the name of *Library.cs* and then **Click** on **Add**.



Type: C# Items

A blank C# code file

Name: Library.cs

Step 7

You will now be in the **View** for the **Code** of *Library.cs* then define a **namespace** allowing classes to be defined together, usually each is separate but will be defined in *Library.cs* by typing the following **Code**:

```
using Comentsys.Assets.Games;
using Comentsys.Toolkit.Binding;
using Comentsys.Toolkit.WindowsAppSdk;
using Microsoft.UI.Xaml;
using Microsoft.UI.Xaml.Controls;
using Microsoft.UI.Xaml.Data;
using Microsoft.UI.Xaml.Markup;
using Microsoft.UI.Xaml.Media;
using System;
using System.Collections.Generic;
using System.Text;
using System.Threading.Tasks;

namespace Chessboard;

public enum ChessBackground
{
    Light,
    Dark
}

// Chess Coordinate Class & Chess Class

// Chess Square Class

// Chess Position Class

// Chess Board Class & Chess Square Style Selector Class

// Chess Piece to Image Source Converter Class

// Binder Class


public class Library
{
    // Constants, Variables, Property & Template Method

    // Tapped & New

}
```

The **`Class`** defined so far *Library.cs* has **`using`** for package of **`Comentsys.Toolkit.WindowsAppSdk`** and others including **`Comentsys.Assets.Games`** along with a **`namespace`** which allows many classes to be defined together, usually a **`class`** is defined per file but to make things easier each will be defined in *Library.cs* instead.

Step 8

Still in *Library.cs* for the **Namespace** of **Chessboard** in *Library.cs* you will define a **class** for **ChessCoordinate** for the locations needed for the *chessboard* and **Chess** to represent the pieces and the colours after the **Comment** of **// Chess Coordinate & Chess Class** by typing the following:

```
public class ChessCoordinate
{
    private const int size = 8;
    private static readonly string[] ranks =
        { "8", "7", "6", "5", "4", "3", "2", "1" };
    private static readonly string[] files =
        { "A", "B", "C", "D", "E", "F", "G", "H" };

    public int Id { get; set; }
    public int Row { get; set; }
    public int Column { get; set; }
    public ChessBackground Background { get; set; }
    public string Notation { get; set; }

    public ChessCoordinate(int id)
    {
        Id = id;
        Row = Id / size;
        Column = Id % size;
        Background = (Row + Column) % 2 == 0 ?
            ChessBackground.Light : ChessBackground.Dark;
        Notation = $"{files[Column]}{ranks[Row]}";
    }
}

public class Chess : ObservableBase
{
    private ChessPieceSet _set;
    private ChessPieceType _type;

    public Chess(ChessPieceSet set, ChessPieceType type) =>
        (_set, _type) = (set, type);

    public ChessPieceSet Set
    {
        get => _set;
        set => SetProperty(ref _set, value);
    }

    public ChessPieceType Type
    {
        get => _type;
        set => SetProperty(ref _type, value);
    }
}
```

Step 9

Still in the **namespace** of **ChessBoard** in *Library.cs* after the **Comment** of **// Chess Square Class** type the following:

```
public class ChessSquare : ObservableBase
{
    private int _id;
    private Chess _piece;
    private ChessCoordinate _coordinate;
    private bool _isSelected;

    public int Id
    {
        get => _id;
        set => SetProperty(ref _id, value);
    }

    public Chess Piece
    {
        get => _piece;
        set => SetProperty(ref _piece, value);
    }

    public ChessCoordinate Coordinate
    {
        get => _coordinate;
        set => SetProperty(ref _coordinate, value);
    }

    public bool IsSelected
    {
        get => _isSelected;
        set => SetProperty(ref _isSelected, value);
    }
}
```

ChessSquare represents a chess piece on the chess board with **Properties**.

Step 10

While still in the **`namespace`** of **`Chessboard`** in *Library.cs* to represent a position and chess piece on the chessboard after the **Comment** of **`// Chess Position Class`** type the following:

```
public class ChessPosition : List<Chess>
{
    private const int size = 8;

    public ChessPosition() : base(new Chess[size * size]) { }

    public ChessPosition(string position) : this()
    {
        int i = 0;
        var black = ChessPieceSet.Black;
        var white = ChessPieceSet.White;
        var pawn = ChessPieceType.Pawn;
        var knight = ChessPieceType.Knight;
        var bishop = ChessPieceType.Bishop;
        var rook = ChessPieceType.Rook;
        var queen = ChessPieceType.Queen;
        var king = ChessPieceType.King;
        foreach (char item in position)
        {
            switch (item)
            {
                case 'p': this[i++] = new Chess(black, pawn); break;
                case 'n': this[i++] = new Chess(black, knight); break;
                case 'b': this[i++] = new Chess(black, bishop); break;
                case 'r': this[i++] = new Chess(black, rook); break;
                case 'q': this[i++] = new Chess(black, queen); break;
                case 'k': this[i++] = new Chess(black, king); break;
                case 'P': this[i++] = new Chess(white, pawn); break;
                case 'N': this[i++] = new Chess(white, knight); break;
                case 'B': this[i++] = new Chess(white, bishop); break;
                case 'R': this[i++] = new Chess(white, rook); break;
                case 'Q': this[i++] = new Chess(white, queen); break;
                case 'K': this[i++] = new Chess(white, king); break;
                case '1':
                case '2':
                case '3':
                case '4':
                case '5':
                case '6':
                case '7':
                case '8': i += int.Parse(item.ToString()); break;
                case '/': if (i % size != 0)
                    throw new ArgumentException("Invalid FEN"); break;
                default:
                    throw new ArgumentException($"Invalid FEN Character: '{item}'");
            }
        }
    }
}
```

Step 11

While still in the **namespace** of **`Chessboard`** in *Library.cs* after the **Comment** of **`// ChessBoard & Chess Square Style Selector`** type the following **Classes**:

```
public class ChessBoard
{
    public ChessSquare[] ChessSquares { get; set; } = new ChessSquare[64];

    public ChessBoard(string fen)
    {
        ChessPosition position = new(fen);
        for (int i = 0; i < position.Count; i++)
        {
            ChessSquares[i] = new ChessSquare
            {
                Id = i,
                Piece = position[i],
                Coordinate = new ChessCoordinate(i)
            };
        }
    }
}

public class ChessSquareStyleSelector : StyleSelector
{
    private const int size = 8;

    public Style Light { get; set; }
    public Style Dark { get; set; }

    protected override Style SelectStyleCore(
        object item, DependencyObject container) =>
        item is ChessSquare square
            ? (square.Id / size + square.Id % size) % 2 == 0 ? Light : Dark
            : base.SelectStyleCore(item, container);
}
```

`Chessboard` will represent the chess board for the game itself with the positions and squares represented and then the **`ChessSquareStyleSelector`** will be used to style the look of the chess board for the light and dark squares.

Step 12

While still in the **namespace** of **`Chessboard`** in *Library.cs* and after the **Comment** of **`// Chess Piece to Image Source Converter Class`** type the following **Class**:

```
public class ChessPieceToImageSourceConverter : IValueConverter
{
    private static readonly Dictionary<string, ImageSource> _sources = new();

    public static async Task SetSourcesAsync()
    {
        if (_sources.Count == 0)
            foreach(var set in Enum.GetValues<ChessPieceSet>())
                foreach(var type in Enum.GetValues<ChessPieceType>())
                    _sources.Add($"{set}{type}",
                    await ChessPiece.Get(set, type).AsImageSourceAsync());
    }

    public object Convert(object value, Type targetType,
        object parameter, string language) =>
        value is Chess piece ? _sources[$"{piece.Set}{piece.Type}"] : null;

    public object ConvertBack(object value, Type targetType,
        object parameter, string language) =>
        throw new NotImplementedException();
}
```

`ChessPieceToImageSourceConverter` will be used to control the displaying of the chess pieces on the chessboard. It has a **Method** to set the image sources for each chess piece set and chess piece type, then this **Class** also implements an **Interface** of **`IValueConverter`** and will be used to return the appropriate value for use with **Data Binding**.

Step 13

While still in the **namespace** of **Chessboard** in *Library.cs* and after the **Comment** of **// Binder** type the following **Class**:

```
public class Binder
{
    public static readonly DependencyProperty GridColumnBindingPathProperty =
    DependencyProperty.RegisterAttached("GridColumnBindingPath",
    typeof(string), typeof(Binder),
    new PropertyMetadata(null, GridBindingPathPropertyChanged));

    public static readonly DependencyProperty GridRowBindingPathProperty =
    DependencyProperty.RegisterAttached("GridRowBindingPath",
    typeof(string), typeof(Binder),
    new PropertyMetadata(null, GridBindingPathPropertyChanged));

    public static string GetGridColumnBindingPath(DependencyObject obj) =>
        (string)obj.GetValue(GridColumnBindingPathProperty);

    public static void SetGridColumnBindingPath(
        DependencyObject obj, string value) =>
        obj.SetValue(GridColumnBindingPathProperty, value);

    public static string GetGridRowBindingPath(DependencyObject obj) =>
        (string)obj.GetValue(GridRowBindingPathProperty);

    public static void SetGridRowBindingPath(
        DependencyObject obj, string value) =>
        obj.SetValue(GridRowBindingPathProperty, value);

    private static void GridBindingPathPropertyChanged(
        DependencyObject obj, DependencyPropertyChangedEventArgs e)
    {
        if (e.NewValue is string path)
        {
            DependencyProperty property = null;
            if (e.Property == GridColumnBindingPathProperty)
                property = Grid.ColumnProperty;
            else if (e.Property == GridRowBindingPathProperty)
                property = Grid.RowProperty;

            BindingOperations.SetBinding(obj, property,
            new Binding { Path = new PropertyPath(path) });
        }
    }
}
```

Binder is used to help with **Data Binding** when producing the layout based on the columns and rows of a **Grid** and will help create labels for each of the squares on the chess board.

Step 14

While still in the **`namespace`** of **`Chessboard`** in *Library.cs* and in the **`class`** of **`Library`** after the **Comment** of **`// Constants, Variables, Property & Template Method`** type the following **Constants**, **Variables, Property** and **Method**:

```
private const int size = 8;
private const string start = "rnbqkbnr/pppppppp/8/8/8/8/PPPPPPPP/RNBQKBNR";
private ChessSquare _square;

public ChessBoard Board { get; set; } = new ChessBoard(start);

private static ItemsPanelTemplate Template()
{
    StringBuilder rows = new();
    StringBuilder columns = new();
    for (int i = 0; i < size; i++)
    {
        rows.Append("<RowDefinition Height=\"*\"/>");
        columns.Append("<ColumnDefinition Width=\"*\"/>");
    }
    return (ItemsPanelTemplate)
    XamlReader.Load($@"<ItemsPanelTemplate
    xmlns='http://schemas.microsoft.com/winfx/2006/xaml/presentation'
    xmlns:x='http://schemas.microsoft.com/winfx/2006/xaml'>
        <Grid>
            <Grid.RowDefinitions>{rows}</Grid.RowDefinitions>
            <Grid.ColumnDefinitions>{columns}</Grid.ColumnDefinitions>
        </Grid>
    </ItemsPanelTemplate>");
}
```

Constants are values that are used in the game that will not change and **Variables** are used to store various values for the game. **`Template`** is used to create the correct layout for the game to produce the rows and columns for the chess board as an **`ItemsPanelTemplate`**.

Step 15

While still in the **`namespace`** of **`Chessboard`** in *Library.cs* and in the **`class`** of **`Library`** after the **Comment** of **`// Tapped & New`** type in the following **Methods**:

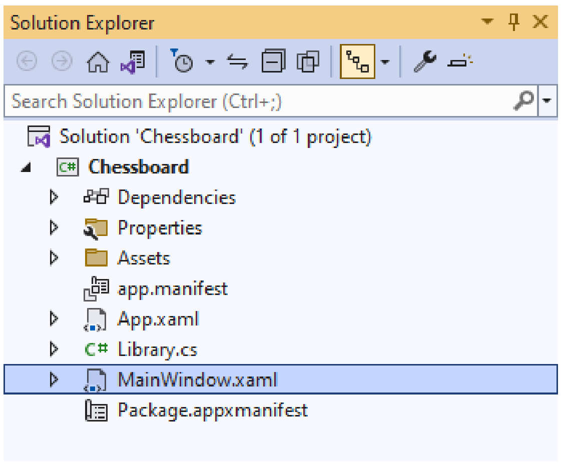
```
public void Tapped(ItemsControl display, ContentPresenter container)
{
    ChessSquare square = (ChessSquare)display.ItemFromContainer(container);
    if (_square == null && square.Piece != null)
    {
        square.IsSelected = true;
        _square = square;
    }
    else if (square == _square)
    {
        square.IsSelected = false;
        _square = null;
    }
    else if (_square?.Piece != null && _square.Piece.Set != square?.Piece?.Set)
    {
        square.Piece = _square.Piece;
        _square.IsSelected = false;
        _square.Piece = null;
        _square = null;
    }
}

public async void New(ItemsControl display)
{
    await ChessPieceToImageSourceConverter.SetSourcesAsync();
    display.ItemsSource = Board.ChessSquares;
    display.ItemsPanel = Template();
    Board = new ChessBoard(start);
}
```

Tapped respond to events from the displayed chess board and allow pieces to be moved although this is a simple movement system which will replace any piece on the board with another piece it could be expanded to implement the actual rules of chess if needed and **New** will setup and start a new game and assign the image source and set things needed for the look-and-feel for the game.

Step 16

Then from **Solution Explorer** for the **Solution** double-click on **MainWindow.xaml** to see the **XAML** for the **Main Window**.



Step 17

In the **XAML** for **MainWindow.xaml** there be some **XAML** for a **`StackPanel`**, this should be **Removed** by removing the following:

```
<StackPanel Orientation="Horizontal"
HorizontalAlignment="Center" VerticalAlignment="Center">
    <Button x:Name="myButton" Click="myButton_Click">Click Me</Button>
</StackPanel>
```

Step 18

While still in the **XAML** for **MainWindow.xaml** below **`<Window`**, type in the following **XAML**:

```
xmlns:ui="using:Comentsys.Toolkit.WindowsAppSdk"
```

The **XAML** for **`<Window>`** should then look as follows:

```
<Window
    xmlns:ui="using:Comentsys.Toolkit.WindowsAppSdk"
    x:Class="Chessboard.MainWindow"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:local="using:Chessboard"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d">
```

Step 19

While still in the **XAML** for **MainWindow.xaml** above **`</Window>`**, type in the following **XAML**:

```
<Grid>
    <Grid.Resources>
        <Style TargetType="ContentPresenter" x:Key="SquareStyle">
            <Setter Property="local:Binder.GridRowBindingPath"
            Value="Coordinate.Row"/>
            <Setter Property="local:Binder.GridColumnBindingPath"
            Value="Coordinate.Column"/>
        </Style>
        <Style TargetType="ContentPresenter" BasedOn="{StaticResource SquareStyle}"
            x:Key="DarkStyle">
            <Setter Property="Background" Value="Peru"/>
            <Setter Property="Foreground" Value="Wheat"/>
        </Style>
        <Style TargetType="ContentPresenter" BasedOn="{StaticResource SquareStyle}"
            x:Key="LightStyle">
            <Setter Property="Background" Value="Wheat"/>
            <Setter Property="Foreground" Value="Peru"/>
        </Style>
        <local:ChessSquareStyleSelector x:Key="ChessSquareStyleSelector"
            Dark="{StaticResource DarkStyle}" Light="{StaticResource LightStyle}"/>
        <local:ChessPieceToImageSourceConverter
        x:Key="ChessPieceToImageSourceConverter"/>
        <ui:BoolToVisibilityConverter x:Key="BoolToVisibilityConverter"/>
        <DataTemplate x:Key="ChessTemplate" x:DataType="local:ChessSquare">
            <Grid IsHitTestVisible="False">
                <Grid.RowDefinitions>
                    <RowDefinition Height="*"/>
                    <RowDefinition Height="Auto"/>
                </Grid.RowDefinitions>
                <Ellipse Grid.Row="0" Grid.RowSpan="2" Fill="Gray" Opacity="0.75"
                        HorizontalAlignment="Stretch" VerticalAlignment="Stretch"
                        Visibility="{Binding IsSelected, Mode=OneWay,
                        Converter={StaticResource BoolToVisibilityConverter}}">
                </Ellipse>
                <Viewbox Grid.Row="0" Grid.RowSpan="2">
                    <Image Height="42" Width="42" Source="{Binding}"
                    DataContext="{Binding Piece, Mode=OneWay,
                    Converter={StaticResource ChessPieceToImageSourceConverter}}"/>
                </Viewbox>
                <TextBlock Grid.Row="1" Margin="1" FontSize="4"
                Text="{Binding Coordinate.Notation}"/>
            </Grid>
        </DataTemplate>
    </Grid.Resources>
    <!-- Viewbox & Command Bar -->

</Grid>
```

This **XAML** contains a **`Grid`** with the resources needed to create the look-and-feel for the chess board including the colours used on the squares and labels and the element when a piece is selected.

Step 20

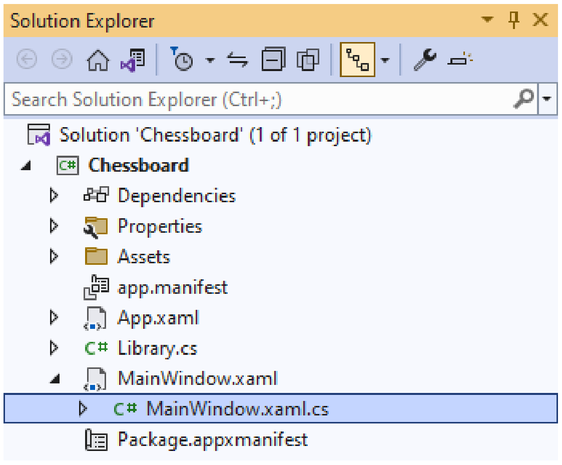
While still in the **XAML** for **MainWindow.xaml** below the **Comment** of **`<!-- Viewbox & Command Bar -->`**, type in the following **XAML**:

```
<Viewbox>
    <ItemsControl Name="Display" Margin="50" Width="400" Height="400"
    ItemContainerStyleSelector="{StaticResource ChessSquareStyleSelector}"
    ItemTemplate="{StaticResource ChessTemplate}"
    Loaded="New" Tapped="Tapped"/>
</Viewbox>
<CommandBar VerticalAlignment="Bottom">
    <AppBarButton Icon="Page2" Label="New" Click="New"/>
</CommandBar>
```

This **XAML** contains a **`Viewbox`** which will **Scale** an **`ItemsControl`** and it has a **`Loaded`** event handler for **`New`** which is also shared by the **`AppBarButton`** and for **`Tapped`**.

Step 21

Then, within **Solution Explorer** for the **Solution** select the arrow next to **MainWindow.xaml** then double-click on **MainWindow.xaml.cs** to see the **Code** for the **Main Window**.



Step 22

In the **Code** for **MainWindow.xaml.cs** there be a **Method** of **`myButton_Click(...)`** this should be **Removed** by removing the following:

```
private void myButton_Click(object sender, RoutedEventArgs e)
{
    myButton.Content = "Clicked";
}
```

Step 23

Once **`myButton_Click(...)`** has been removed, type in the following **Code** below the end of the **Constructor** of **`public MainWindow() { ... }`**:

```
private readonly Library _library = new();

private void Tapped(object sender, TappedRoutedEventArgs e) =>
    _library.Tapped(sender as ItemsControl, e.OriginalSource as ContentPresenter);

private void New(object sender, RoutedEventArgs e) =>
    _library.New(Display);
```

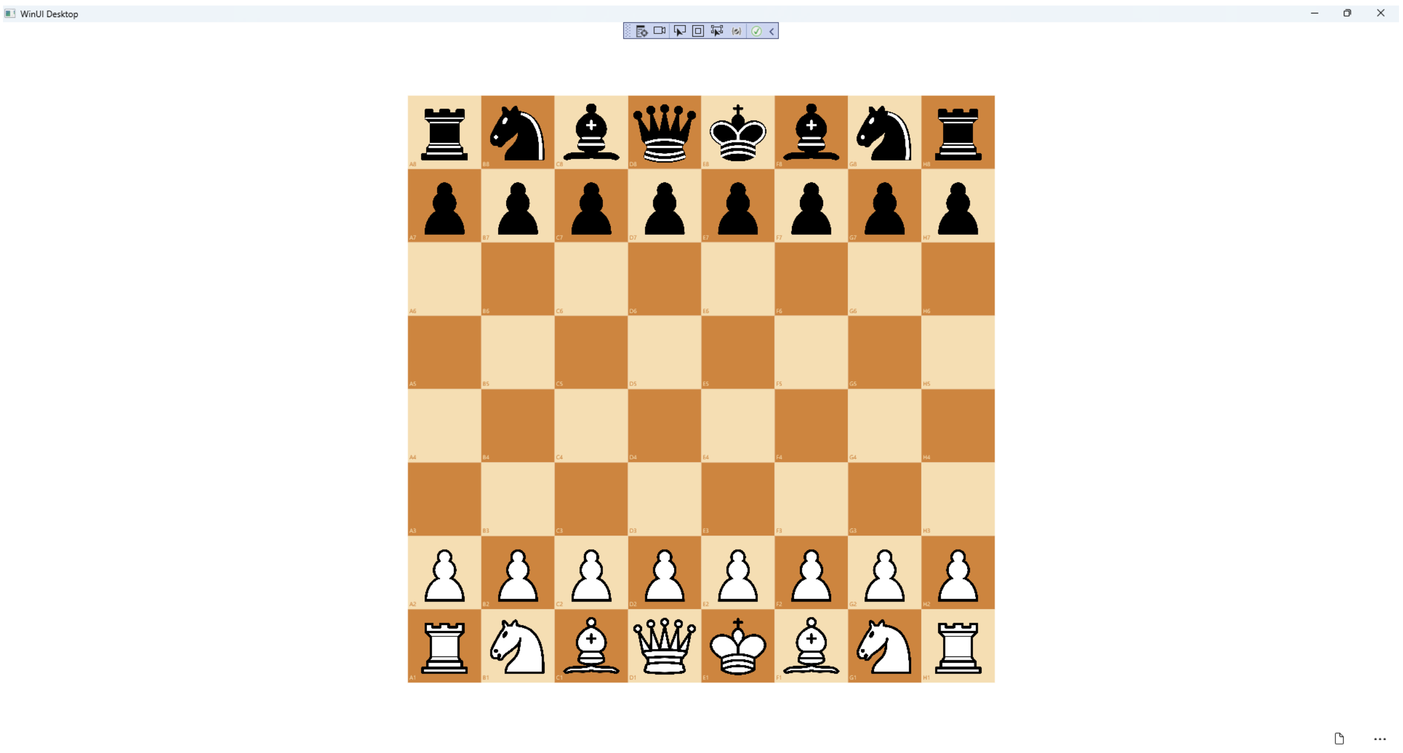
Here an **Instance** of the **Class** of **`Library`** is created then below this is the **Method** of **`Tapped`** and **`New`** that will be used with **Event Handler** from the **XAML**, this **Method** uses Arrow Syntax with the **`=>`** for an Expression Body which is useful when a **Method** only has one line.

Step 24

That completes the **Windows App SDK** application. In **Visual Studio 2022** from the **Toolbar** select **Chessboard (Package)** to **Start** the application.

Step 25

Once running you can tap on the appropriate **Chess Piece** and either move it to an **Empty** square or use to remove an opponent's **Piece** from the **Board** or select *New* to start a new game.



Step 26

To **Exit** the **Windows App SDK** application, select the **Close** button from the top right of the application as that concludes this **Tutorial** for **Windows App SDK** from tutorialr.com!