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tutorial

Windows App SDK

Words Game

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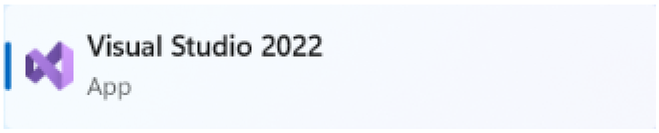
Words Game

Words Game shows how you can create a game based on **Wordle** where the aim is to guess the five-letter word with just five chances to guess correctly using toolkit from **NuGet** using the **Windows App SDK**.

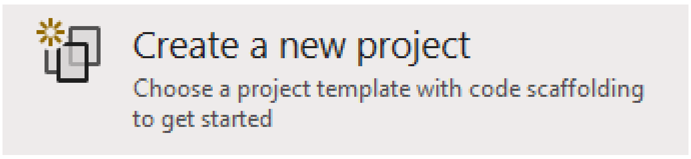
Step 1

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

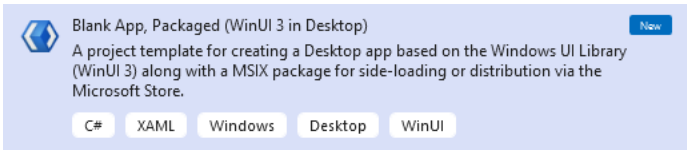
In **Windows 11** choose **Start** and then find or search for **Visual Studio 2022** and then select it.



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

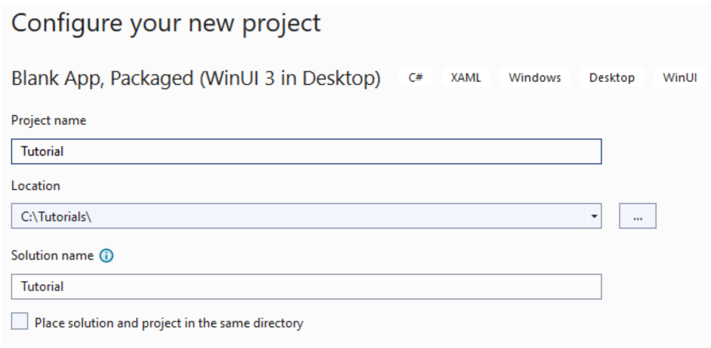

Create a new project
Choose a project template with code scaffolding to get started

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


Blank App, Packaged (WinUI 3 in Desktop)

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 *WordsGame*, then select a Location and then select **Create** to start a new **Solution**.


Configure your new project

Blank App, Packaged (WinUI 3 in Desktop)

Project name: Tutorial

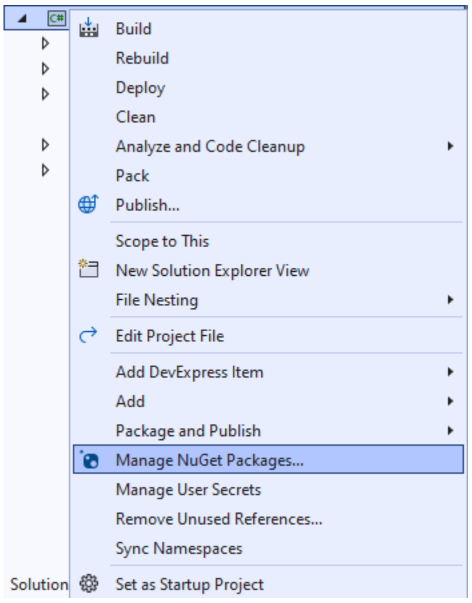
Location: C:\Tutorials\

Solution name: Tutorial

Place solution and project in the same directory

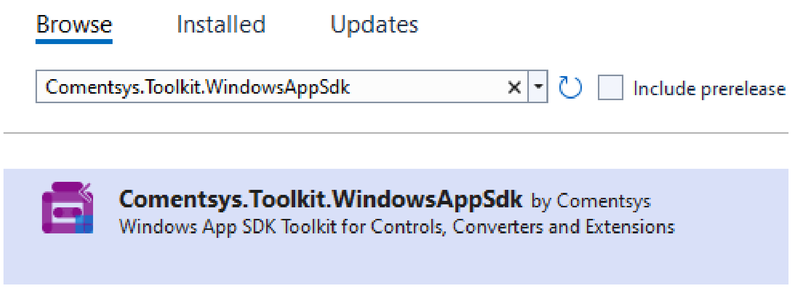
Step 2

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**



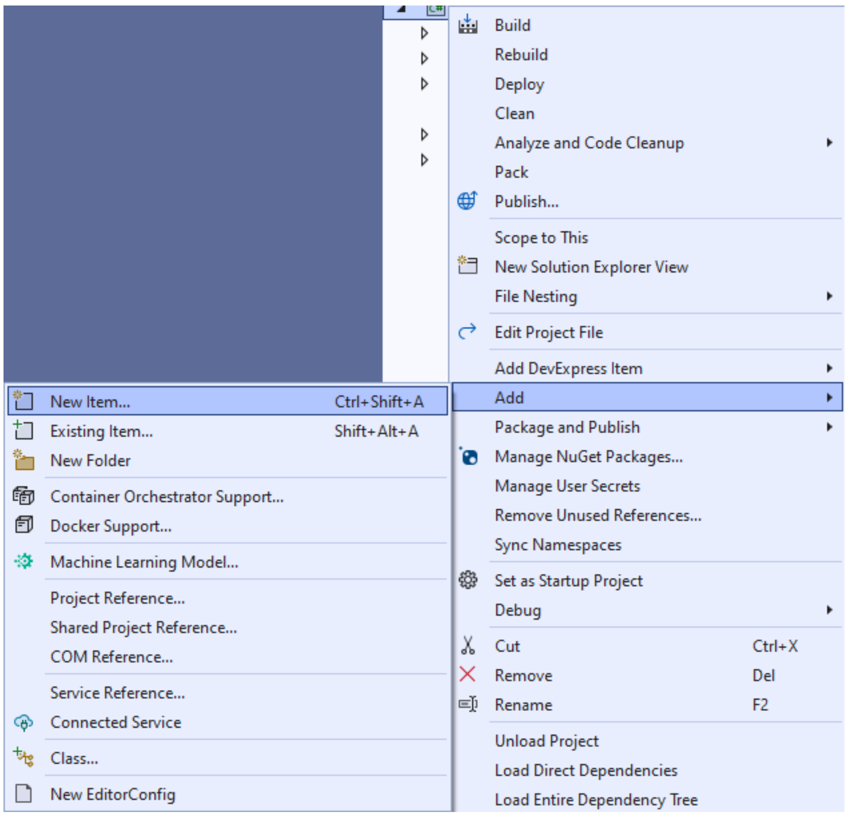
Comentsys.Toolkit.WindowsAppSdk

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, then you can close the **tab** for **Nuget: WordsGame** by selecting the **x** next to it.

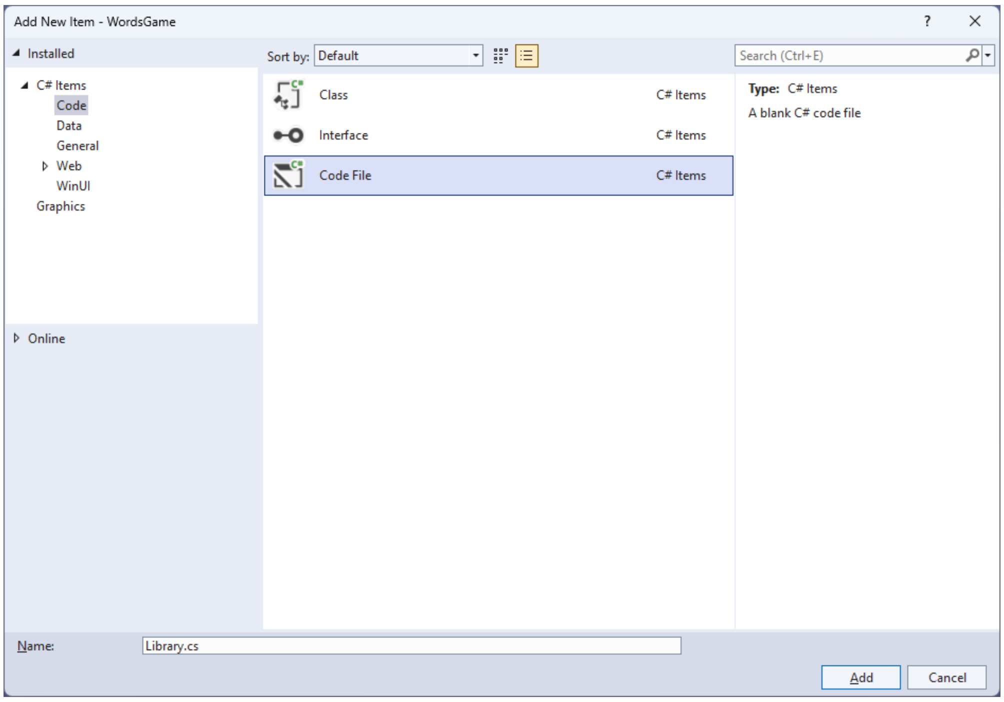
Step 4

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 5

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**.



Name: Library.cs

Step 6

You will now be in the **View** for the **Code** of *Library.cs* to 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** for **using** for **Comentsys.Toolkit.WindowsAppSdk** and others plus an **enum** for **State**.

```
using Comentsys.Toolkit.Binding;
using Comentsys.Toolkit.WindowsAppSdk;
using Microsoft.UI;
using Microsoft.UI.Xaml;
using Microsoft.UI.Xaml.Controls;
using Microsoft.UI.Xaml.Data;
using Microsoft.UI.Xaml.Media;
using System;
using System.Collections.Generic;
using System.Collections.ObjectModel;
using System.IO;
using System.Linq;
using System.Net.Http;
using System.Threading.Tasks;

namespace WordsGame;

public enum State
{
    Key,
    Empty,
    Absent,
    Present,
    Correct
}

// Position Class

// Item Class

// StateToBrushConvertor Class

// ItemTemplateSelector Class

// Words Class

public class Library
{
    // Library Constants, Variables & GetIndexes Method

    // Library ListCurrent, GetCurrent, Set & Check Method

    // Library Over & Select Method

    // Layout Method

    // Setup, Load, Accept & New Methods

}
```

Step 7

Still in *Library.cs* for the **namespace** of **WordsGame** in *Library.cs* you will define a **class** for **Position** after the **Comment** of **// Position Class** by typing the following:

```
public class Position : ObservableBase
{
    private int _row;
    private int _column;
    private char _letter;

    public Position(int row, int column, char letter) =>
        (_column, _row, _letter) = (column, row, letter);

    public int Row
    {
        get => _row;
        set => SetProperty(ref _row, value);
    }

    public int Column
    {
        get => _column;
        set => SetProperty(ref _column, value);
    }

    public char Letter
    {
        get => _letter;
        set => SetProperty(ref _letter, value);
    }
}
```

Position represents a **Row** and **Column** along with the **Letter** and uses **ObservableBase** from the package of **Comentsys.Toolkit.WindowsAppSdk.**

Step 8

Still in *Library.cs* for the **namespace** of **WordsGame** in *Library.cs* you will define a **class** for **Item** after the **Comment** of **// Item Class** by typing the following:

```
public class Item : ActionCommandObservableBase
{
    private State _state;
    private Position _position;

    public Item(Position position, State state) : base(null) =>
        (_position, State) = (position, state);

    public Item(Position position, State state, Action<Position> action) :
        base(new ActionCommandHandler((param) => action(position))) =>
        (_position, State) = (position, state);

    public Position Position
    {
        get => _position;
        set => SetProperty(ref _position, value);
    }

    public State State
    {
        get => _state;
        set => SetProperty(ref _state, value);
    }
}
```

Item has **Properties** for **Position** and **State** uses **ActionCommandObservableBase** from the package of **Comentsys.Toolkit.WindowsAppSdk.**

Step 9

Still in *Library.cs* for the **namespace** of **WordsGame** in *Library.cs* you will define a **class** after the **Comment** of **// StateToBrushConverter Class** by typing the following:

```
public class StateToBrushConverter : IValueConverter
{
    public object Convert(object value, Type targetType,
        object parameter, string language)
    {
        if (value is State state)
        {
            return new SolidColorBrush(value switch
            {
                State.Empty => Colors.White,
                State.Absent => Colors.DarkGray,
                State.Present => Colors.DarkKhaki,
                State.Correct => Colors.DarkSeaGreen,
                _ => Colors.LightGray
            });
        }
        return null;
    }

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

StateToBrushConverter uses the **interface** of **IValueConverter** for **Data Binding** which will allow the colours of the **Item** in the game to be represented from either *White*, *Dark Grey*, *Dark Khaki*, *Dark Sea Green* or *Light Grey* as a **SolidColorBrush**.

Step 10

Still in *Library.cs* for the **namespace** of **`WordsGame`** in *Library.cs* you will define a **`class`** after the **Comment** of **`// ItemTemplateSelector Class`** by typing the following:

```
public class ItemTemplateSelector : DataTemplateSelector
{
    public DataTemplate SpacerItem { get; set; }
    public DataTemplate KeyItem { get; set; }

    protected override DataTemplate SelectTemplateCore
        (object value, DependencyObject container) =>
        value is Item item ? item?.Command != null ?
        KeyItem : SpacerItem : null;
}
```

`ItemTemplateSelector` will be used to provide a different **`DataTemplate`** depending on whether the **`Command`** has been set on an **`Item`**, this will be useful when creating the **Keyboard** used in the game.

Step 11

Still in *Library.cs* for the **namespace** of **`WordsGame`** in *Library.cs* you will define a **`class`** after the **Comment** of **`// Words Class`** by typing the following which will use **`HttpClient`** to get a list of **Words** for the game:

```
public class Words
{
    private const string request =
"https://raw.githubusercontent.com/tutorialr/winappsdk-
tutorials/main/Code/WordsGame/words.txt";
    private readonly List<string> _results = new();
    private readonly HttpClient _client = new();

    public async Task RequestAsync()
    {
        try
        {
            _results.Clear();
            var response = await _client.GetStreamAsync(request);
            using var reader = new StreamReader(response);
            while (!reader.EndOfStream)
            {
                var word = await reader.ReadLineAsync();
                if (word != null)
                    _results.Add(word);
            }
        }
        catch { }
    }

    public List<string> Response => _results;
}
```

Step 12

While still in the **namespace** of **WordsGame** in *Library.cs* and in the **class** of **Library** after the **Comment** of **// Library Constants, Variables & GetIndexes Method** type the following **Constants**, **Variables** and **Method**:

```
private const string title = "Words Game";
private const char backspace = '⌫';
private const char empty = ' ';
private const int count = 5;
private const int keys = 11;
private const int rows = 3;

private readonly Words _words = new();
private readonly ObservableCollection<Item> _keys = new();
private readonly ObservableCollection<Item> _items = new();
private readonly Random _random = new((int)DateTime.UtcNow.Ticks);
private readonly List<char> _letters = new()
{
    'Q', 'W', 'E', 'R', 'T', 'Y', 'U', 'I', 'O', 'P', backspace,
    empty, 'A', 'S', 'D', 'F', 'G', 'H', 'J', 'K', 'L', empty,
    empty, empty, 'Z', 'X', 'C', 'V', 'B', 'N', 'M', empty, empty
};

private Dialog _dialog;
private string _word;
private bool _winner;
private int _column;
private int _row;

public static IEnumerable<int> GetIndexes(string source, char target)
{
    int index = source.IndexOf(target);
    while (index != -1)
    {
        yield return index;
        index = source.IndexOf(target, index + 1);
    }
}
```

Constants are values that are used in the game that will not change, **Variables** are values that will be changed in the game and the **Method** of **GetIndex** is used to get the positions of characters in a **string**.

Step 13

While still in the **namespace** of **`WordsGame`** in *Library.cs* and in the **`class`** of **`Library`** after the **Comment** of **`// Library ListCurrent, GetCurrent, Set & Check Method`** type the following **Methods**:

```
private IEnumerable<Item> ListCurrent() =>
    _items.Where(f => f.Position.Row == _row);

private Item GetCurrent() =>
    _items.FirstOrDefault(
    f => f.Position.Row == _row
    && f.Position.Column == _column);

private void Set(Position position, State state)
{
    var key = _keys.FirstOrDefault(
        f => f.Position.Letter == position.Letter);
    if (key != null)
        key.State = state;
    var item = _items.FirstOrDefault(
        f => f.Position.Row == _row
        && f.Position.Column == position.Column
        && f.Position.Letter == position.Letter);
    if (item != null)
    {
        item.Position.Letter = position.Letter;
        item.State = state;
    }
}

private bool Check()
{
    var current = ListCurrent();
    foreach(var item in current)
    {
        var state = State.Absent;
        var indexes = GetIndexes(_word, item.Position.Letter);
        if(indexes?.Any() == true)
        {
            foreach (var index in indexes)
            {
                state = item.Position.Column == index ?
                    State.Correct : State.Present;
            }
        }
        Set(item.Position, state);
    }
    var word = string.Join(string.Empty, current.Select(s => s.Position.Letter));
    _winner = _word.Equals(word, StringComparison.InvariantCultureIgnoreCase);
    return _winner;
}
```

`ListCurrent` is used to return the items for a given **`Row`** with **`GetCurrent`** returning an **`Item`** for a given **`Row`** and **`Column`** plus **`Set`** is used to update the **`State`** for the **Keyboard** and **Display** of items and **`Check`** is used to determine if the letters are there, in right place or not present at all in the **Word** to guess.

Step 14

While still in the **`namespace`** of **`WordsGame`** in *Library.cs* and in the **`class`** of **`Library`** after the **Comment** of **`// Library Over & Select Method`** type the following **Methods**:

```
private bool Over()
{
    if (_row == count)
    {
        _dialog.Show($"Game Over! You did not get the word {_word}!");
        return true;
    }
    else if(_winner)
    {
        _dialog.Show($"Game Over! You got the word {_word} correct!");
        return true;
    }
    return false;
}

private void Select(Position position)
{
    if (!Over())
    {
        if (position.Letter == backspace)
        {
            if (_column > 0)
            {
                _column--;
                var current = GetCurrent();
                if (current != null)
                {
                    current.State = State.Empty;
                    current.Position.Letter = empty;
                }
            }
        }
        else
        {
            if (_column < count)
            {
                var current = GetCurrent();
                if (current != null)
                {
                    current.State = State.Key;
                    current.Position.Letter = position.Letter;
                    _column++;
                }
            }
        }
    }
}
```

`Over` is used to check if the game has been completed and show the appropriate message using a **`Dialog`** and **`Select`** is used when choosing a letter or using the **`backspace`** option.

Step 15

While still in the **namespace** of **`WordsGame`** in *Library.cs* and in the **`class`** of **`Library`** after the **Comment** of **`// Library Layout Method`** type the following **Method**:

```
private void Layout(ItemsControl display, ItemsControl keyboard)
{
    int index = 0;
    _keys.Clear();
    _items.Clear();
    for (int row = 0; row < count; row++)
    {
        for (int column = 0; column < count; column++)
        {
            _items.Add(new Item(
            new Position(column, row, empty),
            State.Empty));
        }
    }
    display.ItemsSource = _items;
    for (int row = 0; row < rows; row++)
    {
        for (int column = 0; column < keys; column++)
        {
            var letter = _letters[index];
            var position = new Position(row, column, letter);
            if (letter == empty)
                _keys.Add(new Item(position,
                State.Empty));
            else
                _keys.Add(new Item(position,
                State.Key, (Position p) => Select(p)));
            index++;
        }
    }
    keyboard.ItemsSource = _keys;
}
```

Layout is used to create the look and feel of the game including configuring the **Display** and **Keyboard** elements used in the game which use an **`ItemsControl`**.

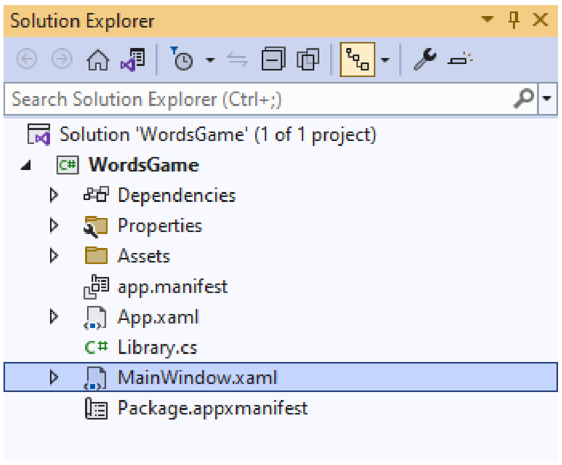
Step 16

While still in the **namespace** of **`WordsGame`** in *Library.cs* and in the **`class`** of **`Library`** after the **Comment** of **`// Setup, Load, Accept & New Method`** type in the following **Methods** for **`Setup`** and **`Load`** which will initialise the game and list of **Words** plus **`Accept`** to confirm the input **Word** and **`New`** to start a new game.

```
private void Setup()
{
    _row = 0;
    _column = 0;
    _winner = false;
    var total = _words.Response.Count;
    if (total > 0)
    {
        var choice = _random.Next(0, total - 1);
        _word = _words.Response[choice];
        foreach (var key in _keys)
            key.State = State.Key;
        foreach (var item in _items)
        {
            item.State = State.Empty;
            item.Position.Letter = empty;
        }
    }
    else
        _dialog.Show("Failed to load Word List!");
}

public async void Load(ItemsControl display, ItemsControl keyboard)
{
    _dialog = new Dialog(display.XamlRoot, title);
    await _words.RequestAsync();
    Layout(display, keyboard);
    Setup();
}

public void Accept()
{
    if(_row < count)
    {
        if (_column == count)
        {
            if (!Check())
            {
                _column = 0;
                _row++;
            }
        }
        else
            _dialog.Show("Not enough letters");
    }
    Over();
}

public void New() =>
    Setup();
```

Step 17

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



Step 18

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 19

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="WordsGame.MainWindow"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:local="using:WordsGame"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d">
```

Step 20

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

```
<Grid>
    <Grid.Resources>
        <local:StateToBrushConverter x:Key="StateToBrushConverter"/>
        <DataTemplate x:Name="ItemTemplate">
            <ui:Piece IsSquare="True"
            Stroke="LightGray"
            Value="{Binding Position.Letter}"
            Fill="{Binding State, Mode=OneWay,
            Converter={StaticResource StateToBrushConverter},
            ConverterParameter=True}" />
        </DataTemplate>
        <DataTemplate x:Name="KeyTemplate">
            <Button Command="{Binding Command}">
                <ui:Piece IsSquare="True"
                Value="{Binding Position.Letter}"
                Fill="{Binding State, Mode=OneWay,
                Converter={StaticResource StateToBrushConverter},
                ConverterParameter=True}" />
            </Button>
        </DataTemplate>
        <DataTemplate x:Name="SpacerTemplate">
            <Grid/>
        </DataTemplate>
        <local:ItemTemplateSelector x:Key="ItemTemplateSelector"
        KeyItem="{StaticResource KeyTemplate}"
        SpacerItem="{StaticResource SpacerTemplate}"/>
    </Grid.Resources>
    <Viewbox>
        <!-- StackPanel -->

    </Viewbox>
    <CommandBar VerticalAlignment="Bottom">
        <AppBarButton Icon="Accept" Label="Accept" Click="Accept"/>
        <AppBarButton Icon="Page2" Label="New" Click="New"/>
    </CommandBar>
</Grid>
```

This **XAML** contains a **`Grid`** with a **`Viewbox`** which will scale a **`StackPanel`** to be added in the next **Step**. It has an event handler for **`Accept`** and **`New`** for each **`AppBarButton`** and defines the **Templates** that will be used in the game.

Step 21

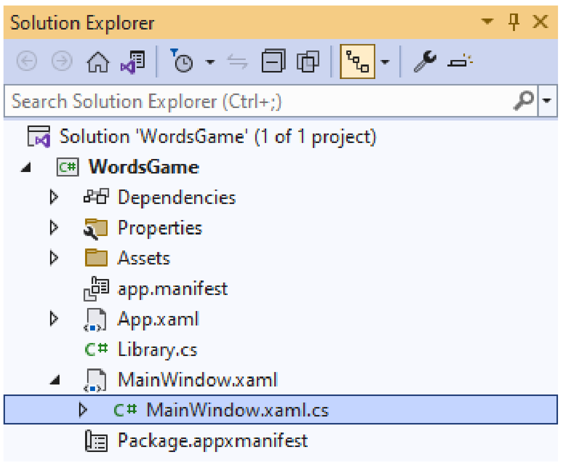
While still in the **XAML** for **MainWindow.xaml** below the **Comment** of **`<!-- StackPanel -->`** type in the following **XAML**:

```
<StackPanel Margin="50" Orientation="Vertical" Loaded="Load">
    <ItemsControl Name="Display" Margin="10"
        HorizontalAlignment="Center"
        ItemTemplate="{StaticResource ItemTemplate}">
        <ItemsControl.ItemsPanel>
            <ItemsPanelTemplate>
                <VariableSizedWrapGrid MaximumRowsOrColumns="5"/>
            </ItemsPanelTemplate>
        </ItemsControl.ItemsPanel>
        <ProgressRing/>
    </ItemsControl>
    <ItemsControl Name="Keyboard" Margin="10"
        HorizontalAlignment="Center"
        ItemTemplateSelector="{StaticResource ItemTemplateSelector}">
        <ItemsControl.ItemsPanel>
            <ItemsPanelTemplate>
                <ItemsWrapGrid MaximumRowsOrColumns="11"
                Orientation="Horizontal"/>
            </ItemsPanelTemplate>
        </ItemsControl.ItemsPanel>
    </ItemsControl>
</StackPanel>
```

This **XAML** contains a **`StackPanel`** with a **`Loaded`** event handler for **`Load`** with the **`ItemsPanel`** for it set to use a **`VariableSizedWrapGrid`** and **`ItemsWrapGrid`** and uses the **`ItemTemplate`** and the previously defined **`class`** of **`ItemTemplateSelector`**.

Step 22

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 23

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 24

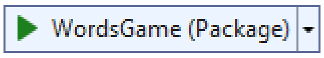
Once **`myButton_Click(...)`** has been removed, type in the following **Code** below the end of the **Constructor** of **`public MainWindow() { ... }`**:

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

private void Load(object sender, RoutedEventArgs e) =>
    _library.Load(Display, Keyboard);

private void Accept(object sender, RoutedEventArgs e) =>
    _library.Accept();

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

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

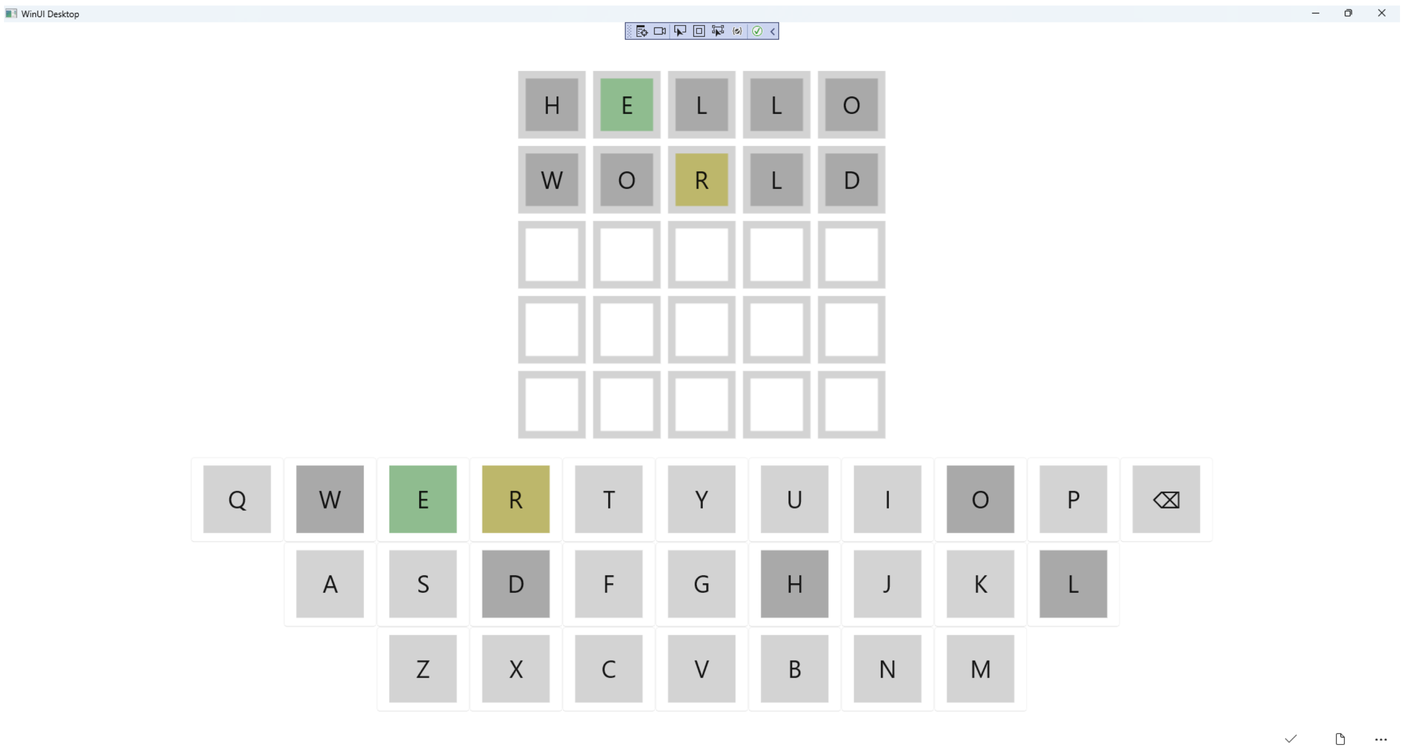
Step 25

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



Step 26

Once running you can then use the on-screen **Keyboard** to enter a **Word** with *5* letters and then use *Accept* then you will see which letters are in the correct position in *Green*, are in the **Word** but in the wrong position in *Yellow* or *Dark Grey* if no letters are in the **Word** and you get *5* chances to guess or you lose so guess correctly to win or you can select *New* to start a new game.



Step 27

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!