Ranorex

实验报告

课程名称：	软件质量保证与测试技术
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1 实验目的

通过实验，要初步掌握 Ranorex 的使用、以及代码编辑来实现自动化功能测试的方法。

2 实验环境

虚拟机：Windows 10 x64

软件：Ranorex 8

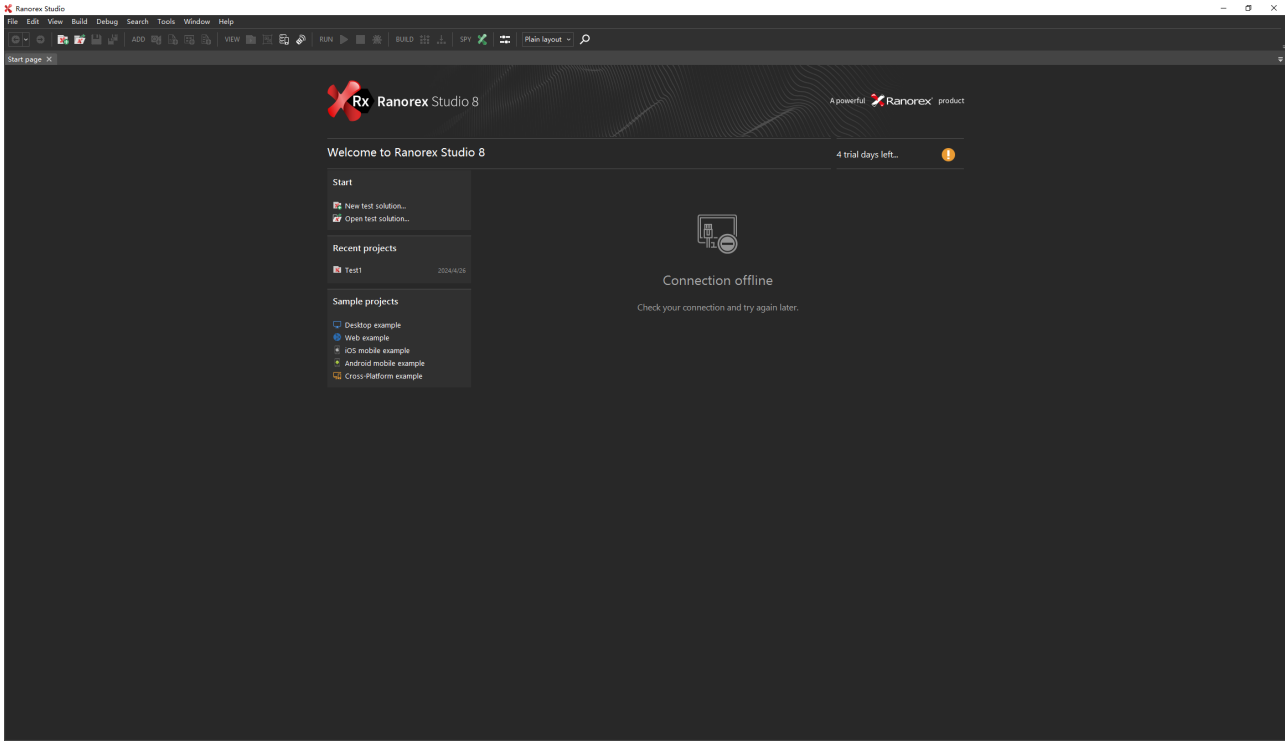
CPU：AMD Ryzen 7 5800H

内存：8GB

3 实验步骤

3.1 Ranorex 部署

文件下载到个人电脑之后需要解压安装。使用试用版的 Ranorex。安装完成后的界面如下：

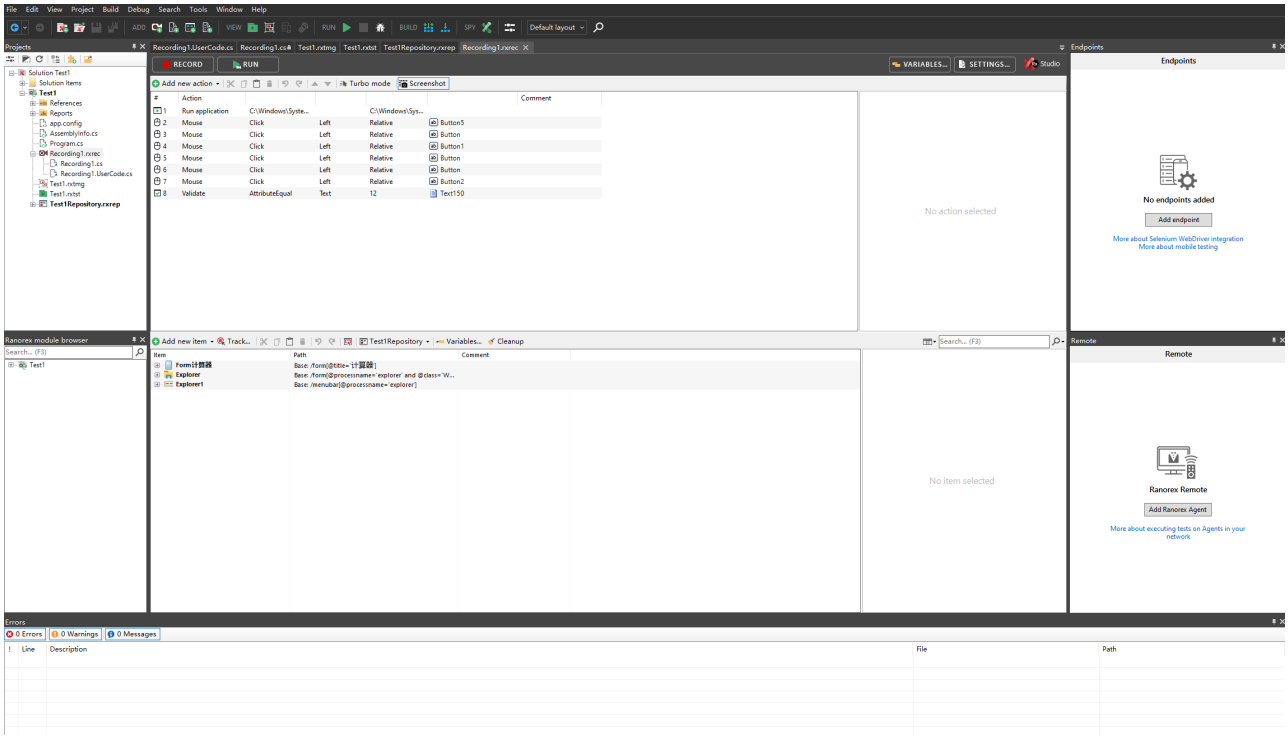


3.2 录制 Ranorex 测试脚本

以计算器为例，进行 Ranorex 测试脚本录制。

新建一个名为 Test1 的项目。项目建成之后，会展示项目界面，并且自动生成一个默认的recording：

在创建完之后，就可以开始录制动作。点击左上角的 `Record` 进行录制。



录制一个空的动作的时候，会提示我们这个动作指向哪一个 APP，这里我们以计算器为例，因此选择 `Desktop` ，然后点击 `Add app`，选择 `C:\Windows\System32` 的 `calc`，开始继续录制。

开始录制之后，右下角有一个录制监听器，监听器中有菜单，此时已经进入录制状态。

在计算器上做操作 `CE` `1` `+` `1` `=` ，计算器便会显示 `2` 这个数据。然后点击 `Validate` 验证。找到 `2` 所在的文本框，点击 `next`，点击结束，这个脚本就可以运行了。

一个完整的脚本，包括动作和验证，如下图所示：

Add new action | Turbo mode | Screenshot

#	Action					Comment
1	Run application	C:\Windows\Sy...		C:\Windows\...		
2	Delay	1s				
3	Mouse	Click	Left	Relative	ClearButton	
4	Delay	200ms				
5	Mouse	Click	Left	Relative	Text1	
6	Mouse	Click	Left	Relative	SomeText1	
7	Mouse	Click	Left	Relative	Num1Button	
8	Mouse	Click	Left	Relative	SomeText	
9	Validate	AttributeEqual	Text	显示为 2	CalculatorResults	
10	Mouse	Click	Left	Relative	Close	

点击 `run` 按钮，开始验证。鼠标会根据之前录制的动作重新执行一次。

下面是执行成功的案例：

Recording1

Success

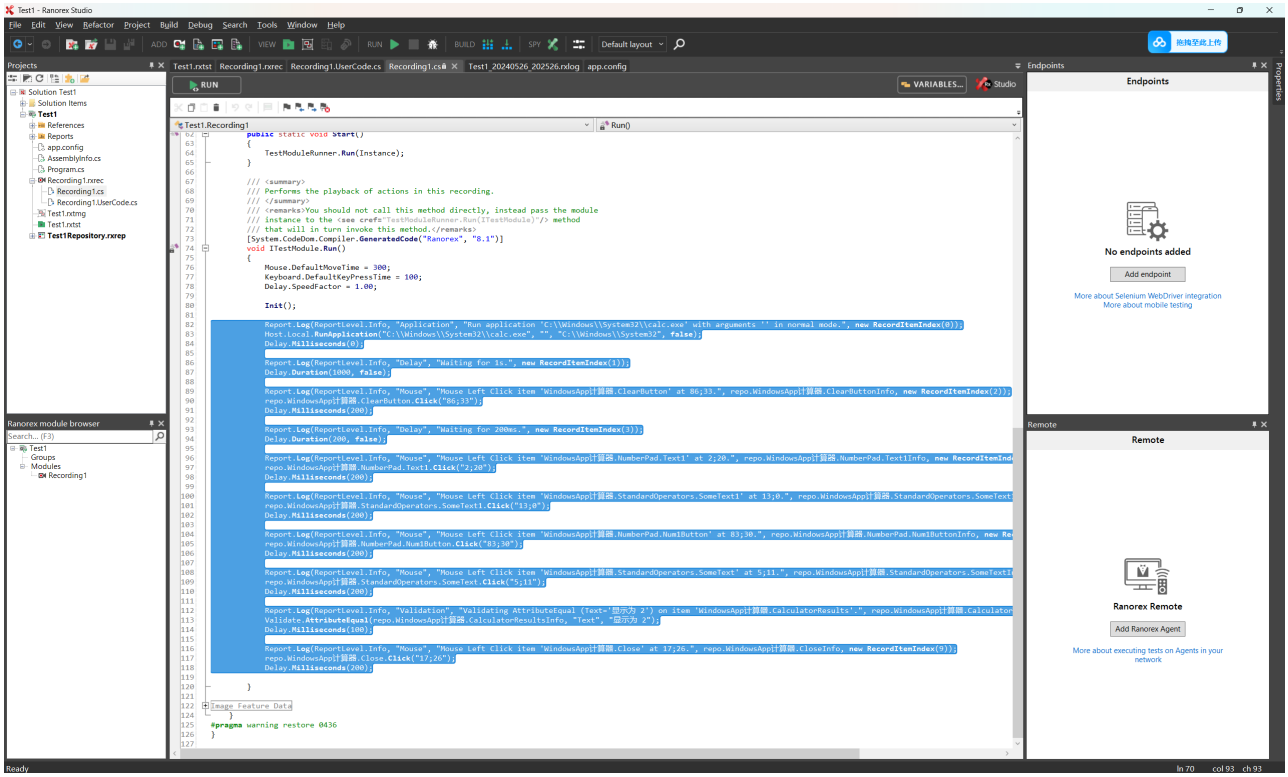
Computer/Endpoint R9000K	Execution time 2024/5/26 20:20:43
Operating system Windows 10 64bit	Screen dimensions 2560x1600
OS Language zh-CN	
Total errors 0	Total warnings 0

Filter: ☑ Info ☑ Success

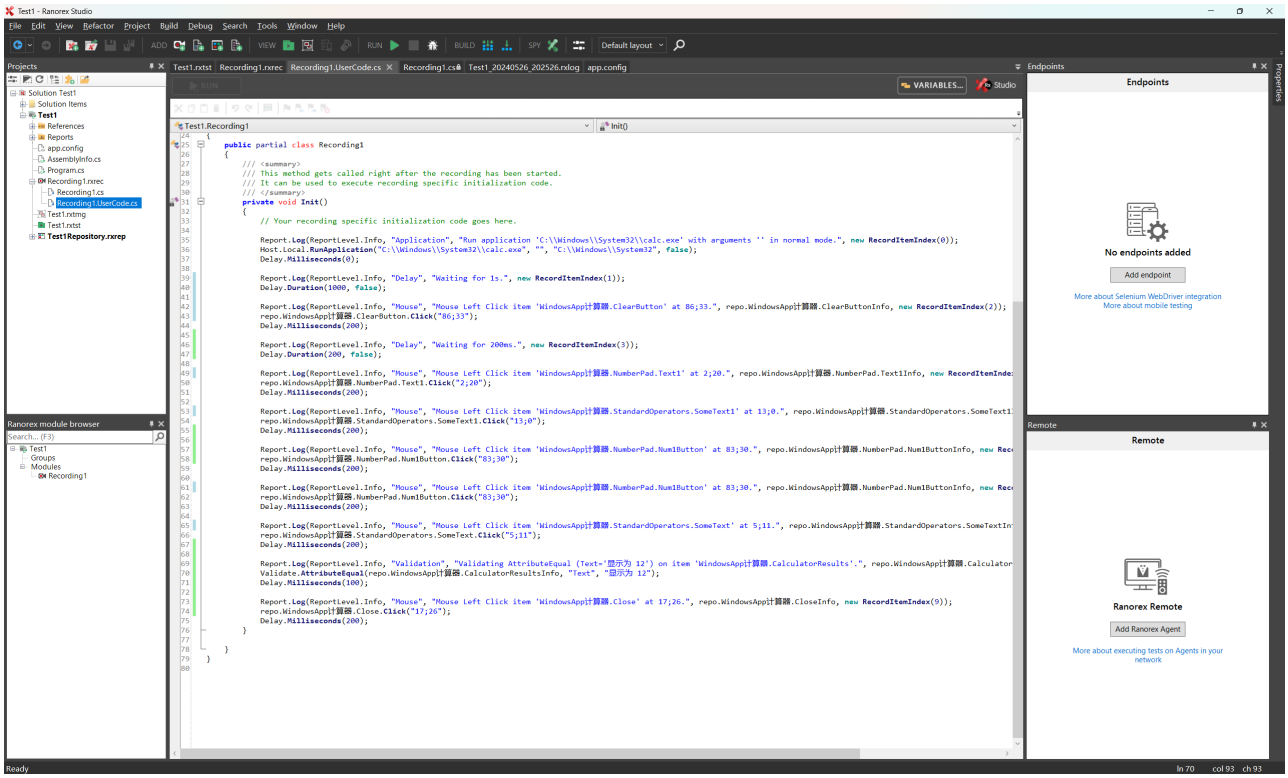
Time	Level	Category	Message
00:00.596	Info	Application	Run application 'C:\Windows\System32\calc.exe' with arguments '' in normal mode.
00:00.656	Info	Delay	Waiting for 1s.
00:01.666	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.ClearButton' at 86;33.
00:04.037	Info	Delay	Waiting for 200ms.
00:04.239	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Text1' at 2;20.
00:05.484	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText1' at 13;0.
00:06.446	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num1Button' at 83;30.
00:07.562	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.
00:08.511	Info	Validation	Validating AttributeEqual (Text='显示为 2') on item 'WindowsApp计算器.CalculatorResults'.
00:08.618	Success	Validation	Attribute 'Text' of element for item 'Test1Repository.WindowsApp计算器.CalculatorResults' does match the specified value.
00:08.729	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.Close' at 17;26.

3.3 利用代码进行功能测试

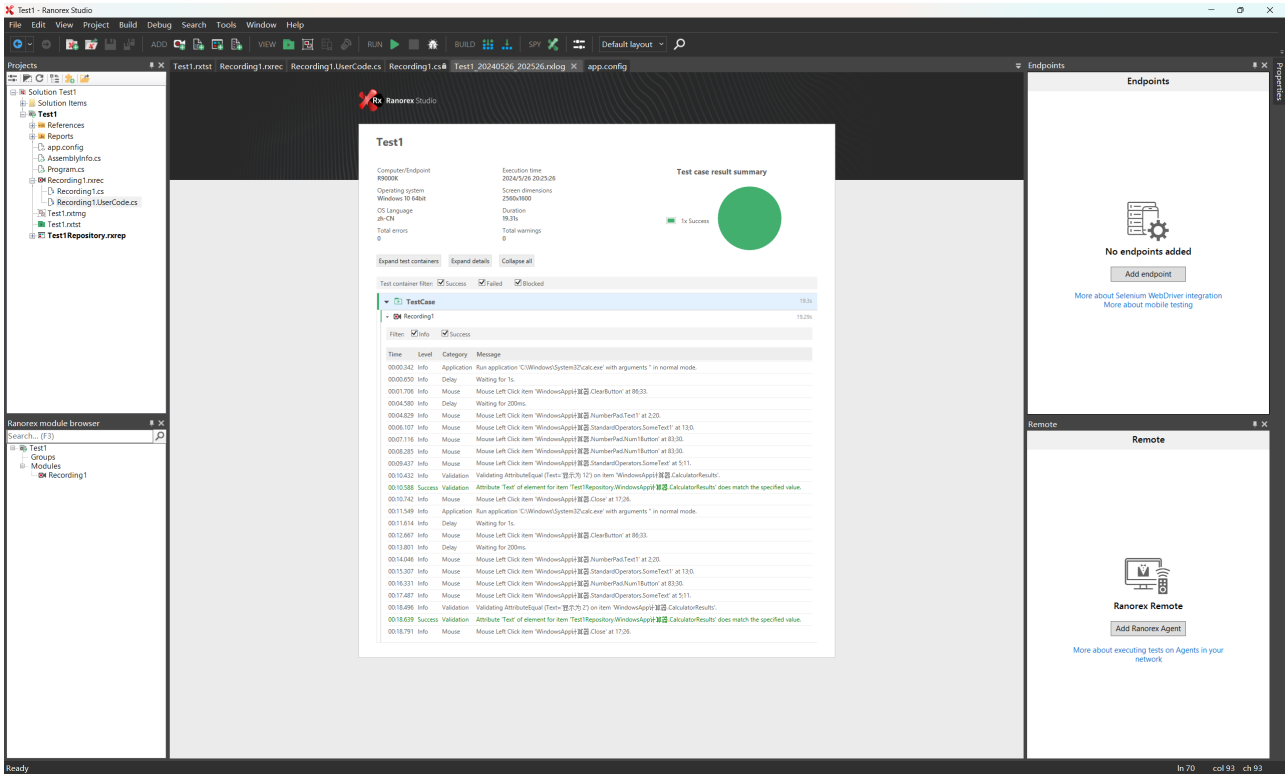
在录制的时候， Ranorex 会生成一份 C# 代码，展示了 Ranorex 内部录制的代码。



用户可以自己进行修改代码实现对其他功能的测试，例如下图所示：



比如在这里，添加了逻辑：`1+11=12`，并启动测试。



测试出来的结果是符合预期的，代表功能正常。接下来，进行其他等价类的功能测试，这就需要测试乘法、除法等。

测试代码（自定义用户脚本）如下：

```
using System;
using System.Collections.Generic;
using System.Text;
```

```
using System.Threading;
using WinForms = System.Windows.Forms;

using Ranorex;
using Ranorex.Core;
using Ranorex.Core.Repository;
using Ranorex.Core.Testing;

namespace Test1
{
    public partial class Recording1
    {
        /// <summary>
        /// This method gets called right after the recording has been started.
        /// It can be used to execute recording specific initialization code.
        /// </summary>
        private void Init()
        {
            // Your recording specific initialization code goes here.

            //打开
            Report.Log(ReportLevel.Info, "Application", "Run application
'C:\\Windows\\System32\\calc.exe' with arguments '' in normal mode.", new
RecordItemIndex(0));
            Host.Local.RunApplication("C:\\Windows\\System32\\calc.exe", "",
"C:\\Windows\\System32", false);
            Delay.Milliseconds(0);

            Report.Log(ReportLevel.Info, "Delay", "Waiting for 1s.", new
RecordItemIndex(1));
            Delay.Duration(1000, false);

            // 清零
            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算
器.ClearButton' at 86;33.", repo.WindowsApp计算器.ClearButtonInfo, new RecordItemIndex(2));
            repo.WindowsApp计算器.ClearButton.Click("86;33");
            Delay.Milliseconds(200);

            //加法 1+11=12
            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算
器.NumberPad.Text1' at 2;20.", repo.WindowsApp计算器.NumberPad.Text1Info, new
RecordItemIndex(4));
            repo.WindowsApp计算器.NumberPad.Text1.Click("2;20");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算
器.StandardOperators.SomeText1' at 13;0.", repo.WindowsApp计算
器.StandardOperators.SomeText1Info, new RecordItemIndex(5));
            repo.WindowsApp计算器.StandardOperators.SomeText1.Click("13;0");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算
器.NumberPad.Num1Button' at 83;30.", repo.WindowsApp计算器.NumberPad.Num1ButtonInfo, new
RecordItemIndex(6));
```

```
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.NumberPad.Num1Button' at 83;30.", repo.WindowsApp计算器.NumberPad.Num1ButtonInfo, new RecordItemIndex(6));
            repo.WindowsApp计算器.NumberPad.Num1Button.Click("83;30");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.", repo.WindowsApp计算器.StandardOperators.SomeTextInfo, new RecordItemIndex(7));
            repo.WindowsApp计算器.StandardOperators.SomeText.Click("5;11");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Validation", "Validating AttributeEqual (Text='显示为 12') on item 'WindowsApp计算器.CalculatorResults'.", repo.WindowsApp计算器.CalculatorResultsInfo, new RecordItemIndex(8));
            Validate.AttributeEqual(repo.WindowsApp计算器.CalculatorResultsInfo, "Text", "显示为 12");
            Delay.Milliseconds(100);

            //乘法 2*7=14

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.NumberPad.Num2Button' at 124;10.", repo.WindowsApp计算器.NumberPad.Num2ButtonInfo, new RecordItemIndex(11));
            repo.WindowsApp计算器.NumberPad.Num2Button.Click("124;10");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.StandardOperators.MultiplyButton' at Center.", repo.WindowsApp计算器.StandardOperators.MultiplyButtonInfo, new RecordItemIndex(10));
            repo.WindowsApp计算器.StandardOperators.MultiplyButton.Click();
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.NumberPad.Num7Button' at 0;16.", repo.WindowsApp计算器.NumberPad.Num7ButtonInfo, new RecordItemIndex(10));
            repo.WindowsApp计算器.NumberPad.Num7Button.Click("0;16");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.", repo.WindowsApp计算器.StandardOperators.SomeTextInfo, new RecordItemIndex(7));
            repo.WindowsApp计算器.StandardOperators.SomeText.Click("5;11");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Validation", "Validating AttributeEqual (Text='显示为 14') on item 'WindowsApp计算器.CalculatorResults'.", repo.WindowsApp计算器.CalculatorResultsInfo, new RecordItemIndex(8));
            Validate.AttributeEqual(repo.WindowsApp计算器.CalculatorResultsInfo, "Text", "显示为 14");
            Delay.Milliseconds(100);
```

```
            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.NumberPad.Num2Button' at 124;10.", repo.WindowsApp计算器.NumberPad.Num2ButtonInfo, new RecordItemIndex(11));
            repo.WindowsApp计算器.NumberPad.Num2Button.Click("124;10");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.StandardOperators.DivideButton' at 19;29.", repo.WindowsApp计算器.StandardOperators.DivideButtonInfo, new RecordItemIndex(11));
            repo.WindowsApp计算器.StandardOperators.DivideButton.Click("19;29");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.NumberPad.Num1Button' at 83;30.", repo.WindowsApp计算器.NumberPad.Num1ButtonInfo, new RecordItemIndex(6));
            repo.WindowsApp计算器.NumberPad.Num1Button.Click("83;30");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.", repo.WindowsApp计算器.StandardOperators.SomeTextInfo, new RecordItemIndex(7));
            repo.WindowsApp计算器.StandardOperators.SomeText.Click("5;11");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Validation", "Validating AttributeEqual (Text='显示为 1') on item 'WindowsApp计算器.CalculatorResults'.", repo.WindowsApp计算器.CalculatorResultsInfo, new RecordItemIndex(8));
            Validate.AttributeEqual(repo.WindowsApp计算器.CalculatorResultsInfo, "Text", "显示为 1");
            Delay.Milliseconds(100);

            //减法 7-2=5

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.NumberPad.Num7Button' at 0;16.", repo.WindowsApp计算器.NumberPad.Num7ButtonInfo, new RecordItemIndex(10));
            repo.WindowsApp计算器.NumberPad.Num7Button.Click("0;16");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.StandardOperators.MinusButton' at 119;2.", repo.WindowsApp计算器.StandardOperators.MinusButtonInfo, new RecordItemIndex(12));
            repo.WindowsApp计算器.StandardOperators.MinusButton.Click("119;2");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.NumberPad.Num2Button' at 124;10.", repo.WindowsApp计算器.NumberPad.Num2ButtonInfo, new RecordItemIndex(11));
            repo.WindowsApp计算器.NumberPad.Num2Button.Click("124;10");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.", repo.WindowsApp计算
```

```
            repo.WindowsApp计算器.StandardOperators.SomeText.Click("5;11");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Validation", "Validating AttributeEqual (Text='显
示为 5') on item 'WindowsApp计算器.CalculatorResults'.", repo.WindowsApp计算
器.CalculatorResultsInfo, new RecordItemIndex(8));
            Validate.AttributeEqual(repo.WindowsApp计算器.CalculatorResultsInfo, "Text",
"显示为 5");
            Delay.Milliseconds(100);

            //关闭
            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算
器.Close' at 17;26.", repo.WindowsApp计算器.CloseInfo, new RecordItemIndex(9));
            repo.WindowsApp计算器.Close.Click("17;26");
            Delay.Milliseconds(200);
        }

    }
}
```

因为此处故意设置了错误，故其是能够发现功能异常的。当`2/1=1`时，ranorex会发现错误：

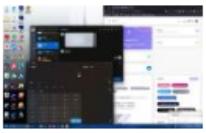
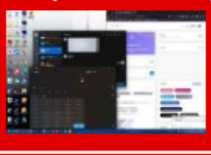
Ranorex Studio

Recording1

Failed

Computer/Endpoint R9000K	Execution time 2024/5/26 22:58:15
Operating system Windows 10 64bit	Screen dimensions 2560x3200
OS Language zh-CN	
Total errors 1	Total warnings 0

Filter: ☑ Info ☑ Error ☑ Success ☑ Failure

Time	Level	Category	Message
00:00.616	Info	Application	Run application 'C:\Windows\System32\calc.exe' with arguments '' in normal mode.
00:00.680	Info	Delay	Waiting for 1s.
00:01.686	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.ClearButton' at 86;33.
00:04.384	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Text1' at 2;20.
00:06.231	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText1' at 13;0.
00:07.368	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num1Button' at 83;30.
00:08.811	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num1Button' at 83;30.
00:10.442	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.
00:11.532	Info	Validation	Validating AttributeEqual (Text='显示为 12') on item 'WindowsApp计算器.CalculatorResults'.
00:11.638	Success	Validation	Attribute 'Text' of element for item 'Test1Repository.WindowsApp计算器.CalculatorResults' does match the specified value.
00:11.751	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num2Button' at 124;10.
00:13.215	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.MultiplyButton' at Center.
00:14.052	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num7Button' at 0;16.
00:15.578	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.
00:16.696	Info	Validation	Validating AttributeEqual (Text='显示为 14') on item 'WindowsApp计算器.CalculatorResults'.
00:16.801	Success	Validation	Attribute 'Text' of element for item 'Test1Repository.WindowsApp计算器.CalculatorResults' does match the specified value.
00:16.915	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num2Button' at 124;10.
00:18.471	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.DivideButton' at 19;29.
00:19.322	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num1Button' at 83;30.
00:20.819	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.
00:22.000	Info	Validation	Validating AttributeEqual (Text='显示为 1') on item 'WindowsApp计算器.CalculatorResults'. 
00:22.104	**Failure**	**Validation**	**Attribute 'Text' of element for item 'Test1Repository.WindowsApp计算器.CalculatorResults' does not match the specified value (actual='显示为 2', expected='显示为 1').** 
			Module execution was aborted because a validation step has failed. Attribute 'Text' of element for item 'Test1Repository.WindowsApp计算器.CalculatorResults' does not match the specified value (actual='显示为 2', expected='显示为 1').

之后，使用的修正的代码如下：

```
using System;
using System.Collections.Generic;
using System.Text;
using System.Text.RegularExpressions;
using System.Drawing;
```

```
using Ranorex;
using Ranorex.Core;
using Ranorex.Core.Repository;
using Ranorex.Core.Testing;

namespace Test1
{
    public partial class Recording1
    {
        /// <summary>
        /// This method gets called right after the recording has been started.
        /// It can be used to execute recording specific initialization code.
        /// </summary>
        private void Init()
        {
            // Your recording specific initialization code goes here.

            //打开
            Report.Log(ReportLevel.Info, "Application", "Run application
'C:\\Windows\\System32\\calc.exe' with arguments '' in normal mode.", new
RecordItemIndex(0));
            Host.Local.RunApplication("C:\\Windows\\System32\\calc.exe", "",
"C:\\Windows\\System32", false);
            Delay.Milliseconds(0);

            Report.Log(ReportLevel.Info, "Delay", "Waiting for 1s.", new
RecordItemIndex(1));
            Delay.Duration(1000, false);

            // 清零
            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算
器.ClearButton' at 86;33.", repo.WindowsApp计算器.ClearButtonInfo, new RecordItemIndex(2));
            repo.WindowsApp计算器.ClearButton.Click("86;33");
            Delay.Milliseconds(200);

            //加法 1+11=12
            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算
器.NumberPad.Text1' at 2;20.", repo.WindowsApp计算器.NumberPad.Text1Info, new
RecordItemIndex(4));
            repo.WindowsApp计算器.NumberPad.Text1.Click("2;20");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算
器.StandardOperators.SomeText1' at 13;0.", repo.WindowsApp计算
器.StandardOperators.SomeText1Info, new RecordItemIndex(5));
            repo.WindowsApp计算器.StandardOperators.SomeText1.Click("13;0");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算
器.NumberPad.Num1Button' at 83;30.", repo.WindowsApp计算器.NumberPad.Num1ButtonInfo, new
RecordItemIndex(6));
            repo.WindowsApp计算器.NumberPad.Num1Button.Click("83;30");
            Delay.Milliseconds(200);
```

```
            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.NumberPad.Num1Button' at 83;30.", repo.WindowsApp计算器.NumberPad.Num1ButtonInfo, new RecordItemIndex(6));
            repo.WindowsApp计算器.NumberPad.Num1Button.Click("83;30");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.", repo.WindowsApp计算器.StandardOperators.SomeTextInfo, new RecordItemIndex(7));
            repo.WindowsApp计算器.StandardOperators.SomeText.Click("5;11");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Validation", "Validating AttributeEqual (Text='显示为 12') on item 'WindowsApp计算器.CalculatorResults'.", repo.WindowsApp计算器.CalculatorResultsInfo, new RecordItemIndex(8));
            Validate.AttributeEqual(repo.WindowsApp计算器.CalculatorResultsInfo, "Text", "显示为 12");
            Delay.Milliseconds(100);

            //乘法 2*7=14

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.NumberPad.Num2Button' at 124;10.", repo.WindowsApp计算器.NumberPad.Num2ButtonInfo, new RecordItemIndex(11));
            repo.WindowsApp计算器.NumberPad.Num2Button.Click("124;10");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.StandardOperators.MultiplyButton' at Center.", repo.WindowsApp计算器.StandardOperators.MultiplyButtonInfo, new RecordItemIndex(10));
            repo.WindowsApp计算器.StandardOperators.MultiplyButton.Click();
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.NumberPad.Num7Button' at 0;16.", repo.WindowsApp计算器.NumberPad.Num7ButtonInfo, new RecordItemIndex(10));
            repo.WindowsApp计算器.NumberPad.Num7Button.Click("0;16");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.", repo.WindowsApp计算器.StandardOperators.SomeTextInfo, new RecordItemIndex(7));
            repo.WindowsApp计算器.StandardOperators.SomeText.Click("5;11");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Validation", "Validating AttributeEqual (Text='显示为 14') on item 'WindowsApp计算器.CalculatorResults'.", repo.WindowsApp计算器.CalculatorResultsInfo, new RecordItemIndex(8));
            Validate.AttributeEqual(repo.WindowsApp计算器.CalculatorResultsInfo, "Text", "显示为 14");
            Delay.Milliseconds(100);

            //除法 2/1=2
```

```
            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.NumberPad.Num2Button' at 124;10.", repo.WindowsApp计算器.NumberPad.Num2ButtonInfo, new RecordItemIndex(11));
            repo.WindowsApp计算器.NumberPad.Num2Button.Click("124;10");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.StandardOperators.DivideButton' at 19;29.", repo.WindowsApp计算器.StandardOperators.DivideButtonInfo, new RecordItemIndex(11));
            repo.WindowsApp计算器.StandardOperators.DivideButton.Click("19;29");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.NumberPad.Num1Button' at 83;30.", repo.WindowsApp计算器.NumberPad.Num1ButtonInfo, new RecordItemIndex(6));
            repo.WindowsApp计算器.NumberPad.Num1Button.Click("83;30");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.", repo.WindowsApp计算器.StandardOperators.SomeTextInfo, new RecordItemIndex(7));
            repo.WindowsApp计算器.StandardOperators.SomeText.Click("5;11");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Validation", "Validating AttributeEqual (Text='显示为 2') on item 'WindowsApp计算器.CalculatorResults'.", repo.WindowsApp计算器.CalculatorResultsInfo, new RecordItemIndex(8));
            Validate.AttributeEqual(repo.WindowsApp计算器.CalculatorResultsInfo, "Text", "显示为 2");
            Delay.Milliseconds(100);

            //减法 7-2=5

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.NumberPad.Num7Button' at 0;16.", repo.WindowsApp计算器.NumberPad.Num7ButtonInfo, new RecordItemIndex(10));
            repo.WindowsApp计算器.NumberPad.Num7Button.Click("0;16");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.StandardOperators.MinusButton' at 119;2.", repo.WindowsApp计算器.StandardOperators.MinusButtonInfo, new RecordItemIndex(12));
            repo.WindowsApp计算器.StandardOperators.MinusButton.Click("119;2");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.NumberPad.Num2Button' at 124;10.", repo.WindowsApp计算器.NumberPad.Num2ButtonInfo, new RecordItemIndex(11));
            repo.WindowsApp计算器.NumberPad.Num2Button.Click("124;10");
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.", repo.WindowsApp计算器.StandardOperators.SomeTextInfo, new RecordItemIndex(7));
```

```
            Delay.Milliseconds(200);

            Report.Log(ReportLevel.Info, "Validation", "Validating AttributeEqual (Text='显示为 5') on item 'WindowsApp计算器.CalculatorResults'.", repo.WindowsApp计算器.CalculatorResultsInfo, new RecordItemIndex(8));
            Validate.AttributeEqual(repo.WindowsApp计算器.CalculatorResultsInfo, "Text", "显示为 5");
            Delay.Milliseconds(100);

            //关闭
            Report.Log(ReportLevel.Info, "Mouse", "Mouse Left Click item 'WindowsApp计算器.Close' at 17;26.", repo.WindowsApp计算器.CloseInfo, new RecordItemIndex(9));
            repo.WindowsApp计算器.Close.Click("17;26");
            Delay.Milliseconds(200);
        }

    }
}
```

修改完，重新运行功能测试，结果如下：

Ranorex Studio

Recording1

Success

Computer/Endpoint **R9000K**	Execution time **2024/5/26 23:00:51**
Operating system **Windows 10 64bit**	Screen dimensions **2560x3200**
OS Language **zh-CN**	
Total errors **0**	Total warnings **0**

Filter: ☑ Info ☑ Success

Time	Level	Category	Message
00:00.947	Info	Application	Run application 'C:\Windows\System32\calc.exe' with arguments '' in normal mode.
00:01.036	Info	Delay	Waiting for 1s.
00:02.051	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.ClearButton' at 86;33.
00:06.911	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Text1' at 2;20.
00:09.456	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText1' at 13;0.
00:11.015	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num1Button' at 83;30.
00:13.092	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num1Button' at 83;30.
00:15.246	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.
00:16.731	Info	Validation	Validating AttributeEqual (Text='显示为 12') on item 'WindowsApp计算器.CalculatorResults'.
00:16.906	Success	Validation	Attribute 'Text' of element for item 'Test1Repository.WindowsApp计算器.CalculatorResults' does match the specified value.
00:17.011	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num2Button' at 124;10.
00:19.135	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.MultiplyButton' at Center.
00:20.056	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num7Button' at 0;16.
00:22.257	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.
00:23.709	Info	Validation	Validating AttributeEqual (Text='显示为 14') on item 'WindowsApp计算器.CalculatorResults'.
00:23.881	Success	Validation	Attribute 'Text' of element for item 'Test1Repository.WindowsApp计算器.CalculatorResults' does match the specified value.
00:23.989	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num2Button' at 124;10.
00:26.297	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.DivideButton' at 19;29.
00:27.216	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num1Button' at 83;30.
00:29.360	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.
00:30.866	Info	Validation	Validating AttributeEqual (Text='显示为 2') on item 'WindowsApp计算器.CalculatorResults'.
00:31.041	Success	Validation	Attribute 'Text' of element for item 'Test1Repository.WindowsApp计算器.CalculatorResults' does match the specified value.
00:31.148	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num7Button' at 0;16.
00:33.365	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.MinusButton' at 119;2.
00:34.288	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.NumberPad.Num2Button' at 124;10.
00:36.424	Info	Mouse	Mouse Left Click item 'WindowsApp计算器.StandardOperators.SomeText' at 5;11.

这样发现就不会出现问题了，符合预期的结果。