**Plotter Test Plan Document**

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**1. Introduction**

The Plotter programs was given us as a project to help us learn how to test as thoroughly, efficiently, and professionally as possible. Our goal is to eradicate any bugs, errors, or faults that we can by implementing a test plan in the best manner possible.

After testing, this program should be able to accomplish the following:

- Graph functions in Cartesian 2D, Cartesian 3D, and Polar coordinate systems.

- Graph the corresponding derivative function of the one already displayed.

- Calculate the integral of the function, using the Gaussian, Simpson, or Trapezium methods.

- Change the color scheme of the graph or background panel.

- Save the graph as an image file, or export the data in a different format.

- Zoom in or out or center on different portions of the graph.

**1.1 Test Plan Objectives**

The objectives of this test plan are

- To describe what unit tests and integration tests need to be performed.

- To enhance communication between members of the team.

- To set a schedule in place for the completion of these tests.

**1.2 Test Scope**

The unit tests will cover all classes and their dominant methods

Functionality and acceptance testing will cover

- The integral panel and calculations

- Graphing derivatives (for functions that have no derivative as well)

- The functionality of the buttons in the menu bar

- Zoom/centering functions in all coordinate systems.

**1.3 Major Constraints**

- Time is a major constraint on this project. Everything must be completed by 12/3/2016.

- Communication is also a constraint since all members of the team live in different areas of the

country and cannot have any face to face meetings.

- Another constraint is that no team member is an experienced software tester. Some aspects of

testing might be overlooked due to inexperience.

**2. Test Plan**

**2.1 Software To Be Tested**

The software to be tested is the Plotter software.

**2.2 Testing Strategy**

We will use JUnit and ECLemma to unit test each of the classes and their dominant methods and

analyze code coverage of the tests. Afterwards, we will use functionality testing to make sure

the various functions of the program work as expected. Creating and documenting the functionality tests will probably take the most time and effort, so more effort should be applied there. Creating the JUnit tests, on the other hand shouldn’t be too difficult, so minimal effort would be applied here.

**2.2.1 Unit Testing**

The names of the classes to be unit tested are LineData, Point3D, Polygon3D, Renderer3D,

ZBuffer, AdvancedCalculator, Calculator, MathTree, ParseFunction, TNode, and Visualizer. These need to be white-box tested because they are not explored or tested in functionality testing. Most of the focus should be given to Visualizer, Renderer3D, and Calculator and their methods.

**2.2.2 Functionality Testing**

In the functionality testing phase, we will develop a series of tests to demonstrate the

functionality of the software in a black box testing approach. In case of any failure of the

program, we will create a list of defects to be used for creating fixes or future implementations.

This section will test the various interfaces of the system. Namely, the ExportDataPanel, the

IntegralPanel, the Colorpanel, and the main interface.

**3.0 Test Procedure**

**3.1 Software To Be Tested**

The software to be tested with unit tests are the LineData, Point3D, Polygon3D, Renderer3D,

Zbuffer, Visualizer, AdvancedCalculator, Calculator, MathTree, ParseFunction, and TNode

classes. The remaining classes, ColorPanel, DigitTextField, ExportDataPanel, FunctionTextField,

and, IntegralPanel will all be tested with functionality testing. The last class, Main, is a simple

driver which does not need testing.

**3.2.1 Unit Test Cases**

|  |  |  |  |
| --- | --- | --- | --- |
| **TC#** | **Description** | **Input** | **Expected Results** |
| **1** | Calculate Derivative – Trigonometric function | a = 0.0, b = 6.29, n = 4  y = sin(x) | [1, 0, -1, 0] |
| **2** | Calculate Derivative – Logarithmic function | a = 2.0, b = 10.0, n = 4  y = ln(x) | [1/2, 1/4, 1/6, 1/8] |
| **3** | Calculate Derivative – Exponential function | a = 0.0, b = 10.0, n = 5  y = x^2 – 4x | [-4, 0, 4, 8, 12] |
| **4** | Calculate Derivative – Square Root function | a = 2.0, b = 10.0, n = 4  y = sqrt(8x) | [1, sqrt(2)/2, sqrt(2)/sqrt(6), sqrt(2)/sqrt(8)] |
| **5** | Simpson Integral – Trigonometric function | a = 0.0, b = 6.29,  y = cos(x) | .00681464 |
| **6** | Simpson Integral – Logarithmic function | a = 0.0, b = 10.0,  y = e^x | 22025.5 |
| **7** | Simpson Integral – Exponential function | a = 0.0, b = 10.0,  y = 10x -4x^2 | -833.333 |
| **8** | Simpson Integral – Square root function | a = 0.0, b = 10.0,  y = sqrt(3x^3) | 219.089 |
| **9** | Trapezium Integral – Trigonometric function | a = 0.0, b = 6.29,  y = tan(x) | 1.94902 |
| **10** | Trapezium Integral – Logarithmic function | a = 0.0, b = 10.0,  y = 1/ln(x) | 6.16138 |
| **11** | Trapezium Integral – Exponential function | a = 0.0, b = 10.0,  y = 2x^3-x^2 | 4666.67 |
| **12** | Trapezium Integral – Square root function | a = 0.0, b = 10.0,  y = sqrt(x/(x^2 + 4)) | 3.9698 |
| **13** | Gauss Integral – Trigonometric function | a = 0.0, b = 6.29,  y = sin(x) |  |
| **14** | Gauss Integral – Logarithmic function | a = 0.0, b = 10.0,  y = e^(-x) |  |
| **15** | Gauss Integral – Exponential function | a = 0.0, b = 10.0,  y = x^4 – 4x |  |
| **16** | Gauss Integral – Square root function | a = 0.0, b = 10.0,  y = sqrt(x^4 – 4x) |  |
| **17** | Zbuffer – Hex to color conversion | s = “FFFFFF” | r = FF(hex), g = FF(hex), b = FF(hex) |
| **18** | Zbuffer – Color to hex conversion | r = 1, g = B(hex), b = 4 | s = “011104” |
| **19** | Zbuffer – Add zeroes | hexString = “1” | (return) = “01” |
| **20** | Zbuffer – Don’t add zeroes | hexString = “12” | (return) = “12” |
| **21** | LineData – Clone LineData | ldOld = {1, 2, 3, 4} | ldNew = {1, 2, 3, 4} |
| **22** | LineData – Decompose LineData | ld {1, 2, 3, 4} | str = “1,2,3,4” |
| **23** | LineData – Position of function | i = 5, ld = {1, 3, 4, 7} | (return) = -1 |
| **24** | Polygon3D – Add Point Function | xpoints = {}, ypoints = {}, zpoints = {}, npoints = 0  x = 1, y = 1, z = 1 | xpoints = {1}, ypoints = [1], zpoints = [1], npoints = 1 |

**3.2.2 Calculation Functionality Test Cases**

|  |  |  |  |
| --- | --- | --- | --- |
| **TC#** | **Description** | **Execution** | **Expected Results** |
| **1** | Open program | Run Plotter software, or click on executable jar | Program should open |
| **2** | Draw Function | Enter function into bar at top and hit “Draw” | A line should appear that represents given function over the specified integral. Verify that the line is correct for whatever input given. |
| **3** | Draw Derivative | Click on “Show DF” | A different colored line should appear. Verify that the line is correct for the derivative for whatever input is given. |
| **4** | Calculate Simpson Integral | Click on “Integral” select “Simpson” and click “Recalculate” | The integral should be calculated for n = 1000. Verify the results for the function and the interval given. |
| **5** | Calculate Trapezium Integral | Click on “Integral” select “Trapezium” and click “Recalculate” | The integral should be calculated for n = 1000. Verify the results for the function and the interval given. |
| **6** | Calculate Gauss Integral | Click on “Integral” select “Gauss” and click “Recalculate” | The integral should be calculated for n = 1000. Verify the results for the function and the interval given. |
| **7** | Draw 3D plane | Click on 3D Cartesian  Input “x+y” into function text field. Click “draw” | The plane displayed should be a diagonal plane through the origin. |
| **8** | Draw 3D plane translated 1 unit | Click on 3D Cartesian. Input “x+y+1” | The plane will be the same as in test 7 but moved up vertically 1 unit. |
| **9** | Draw polar equation on 3D system | Click on Cartesian 3D. Input “sin(teta)” in function text field. Click “draw” | Should display a sin(x) curve on the graph. |
| **10** | Enter invalid function for 3D system | Click on Cartesian 3D. Input “sin(b)” in function text field. Click “draw” | Program should display error message, saying “Error in parsing function! Please read the readme.txt” |
| **11** | Draw 2D function | From Cartesian 2D system, enter “3x + 1” into function text field and click “draw” | Graph should display a sharply upward diagonal line translated up one unit. |
| **12** | Draw a 3D function on 2D Cartesian | From the Cartesian 2D system, input “x+y” into the function text field and click “draw” | Should receive an error message, or a flat vertical line should appear on the graph. |
| **13** | Draw an invalid function on 2D Cartesian | From the Cartesian 2D system, input “b” into the function text field and click “draw” | Error message should be displayed. |
| **14** | Draw Polar 2D curve | Click on Polar 2D and input “2\*cos(teta)+sin\*(teta)” in the function text field and click “draw” | Should display a circle translated up and to the right of the origin. |
| **15** | Invalid function in Polar 2D | Click on Polar 2D and input “b” into the function text field and click “draw” | Error message should be displayed. |
| **16** | Draw 3D function in Polar 2D | Click on Polar 2D and input “x+y” into the function text field and click “draw” | Function should be displayed since y and x are still variables in the Polar 2D system. |

**Test Case: Test to verify that the Plotter program saves an image**

|  |  |  |
| --- | --- | --- |
| **S.N** | **Execution Steps** | **Expected Results** |
| 1 | Click the save menu tab | A drop-down list appears with the menu choices:  1)Save Image  2)Export Data |
| 2 | Click the Save Image button at the top menu | Window opens up allowing you to specify the location. |
| 3 | Click the “Open” button to save | Image file gets saved |

**Test Case: Test to verify the Colors options change the desired components to the desired color**

|  |  |  |
| --- | --- | --- |
| **S.N** | **Execution Steps** | **Expected Results** |
| 1 | Click the “Colors” menu tab | The “Change Colors” drop menu is there and clicking it causes the color panel to appear |
| 2 | Verify the BACKGROUND\_COLOR works | Picking the desired color and clicking OK should change the background color of the plotter graph area and clicking Save on the color panel should change the color permanently |
| 3 | Verify the PANEL\_COLOR works | Picking the desired color and clicking OK should change the panel color of the plotter area outside the graph and clicking Save on the color panel should change the color permanently |
| 4 | Verify the LINE\_COLOR works | Picking the desired color and clicking OK should change the line color on the plotter graph area and clicking Save on the color panel should change the color permanently |
| 5 | Verify the LINE\_2\_COLOR works | Picking the desired color and clicking OK should change the line 2 color on the plotter graph area and clicking Save on the color panel should change the color permanently |
| 6 | Verify the AXIS\_COLOR works | Picking the desired color and clicking OK should change the axis color on the plotter graph area and clicking Save on the color panel should change the color permanently |
| 7 | Verify the LINE\_3D\_COLOR | Picking the desired color and clicking OK should change the line 3D color on the plotter graph area and clicking Save on the color panel should change the color permanently |
| 8 | Verify the Reset button works | Clicking the Reset button on any color option should change that color to white |

**Test Case: Test to verify the color changes exist after closing and opening the Plotter program**

|  |  |  |
| --- | --- | --- |
| **S.N** | **Execution Steps** | **Expected Results** |
| 1 | Change the color of any of the graph components and click Save and then close the program | The color changes and the program closes |
| 2 | Open the program again | The color changes from last use are still persistent |