

**University of Toronto**  
**Department of Computer Science**  
**CSC302S – Engineering Large Software Systems**

March 1, 2009  
Prof. Steve Easterbrook

**Assignment 3: Requirements Analysis**

**Due Date:** 11:20am, Thursday, March 19, 2008  
(i.e. within 10 minutes of the start of the tutorial)

*This assignment counts for 15% of the final grade*

Analyze the requirements for a new feature request for the JFreeChart application. You will need to select one of the new feature requests listed below. Your analysis will include a goal model to explore the user's requirements, a domain model to map out the domain entities, and a set of use cases describing how the users will use the requested feature. Finally, you will complete a robustness analysis to explore how these use cases map onto the architecture of JFreeChart. You are not required to implement the new feature for this assignment (but will be doing so for the next assignment).

The project is to be carried out in your assigned teams. Each team will submit one report.

## **I. Doing the Assignment**

This assignment has 7 steps. They are:

1. *Read the list of new feature requests provided on the next page.* Check that you understand what each feature is. Ask your TA or the instructor if you need any user clarifications.
2. *Select one of the listed features for the assignment.* Use techniques you have learned in the course for estimating effort, assessing risk, and understanding customer priority to help you make the selection. You will be expected to defend your decision in the project write up. Note: you are strongly encouraged to investigate whether existing libraries and/or (open-source) implementations of any of the requested functionality can be re-used for your implementation.
3. *Complete a requirements analysis for the selected feature.* Your requirements analysis will identify why the user(s) want the requested feature, and will identify relevant assumptions about the problem domain. At the end of the analysis, you should have a detailed list of specific functions and quality requirements, along with a rationale for how the functions will allow the users to meet their goals. Make use of techniques such as domain modeling and goal modeling to help you complete this analysis.
4. *Generate a detailed set of use cases for the selected feature.* Create a use case diagram to give an overview of the set of use cases, and create individual descriptions for each use case, including pre- and post-conditions, exceptional behaviour, and alternative paths for each use case. Your use case descriptions should be written in a style that the users would understand, so that, for example, they could form the basis for a user manual.
5. *Complete a robustness analysis for your use cases.* Your robustness analysis should take into account the existing classes in the JFreeChart application, plus any new classes you need to create to implement the new feature. Use the robustness analysis to decide whether each requirement should map onto a new or an existing class.

6. *Write a report* that describes the steps you went through to select and analyze the new feature request for JFreeChart. Be sure to document your development process, and comment on how well the process worked for you.
7. *Document your teamwork* and complete team member evaluation forms, using the online system on the course website.

## II. List of change requests

You should select one from the following (unordered) list of new feature requests:

1. Currently, to plot a mathematical function you need to first sample it to create a dataset and then plot that (See for example XY Charts, Function2DDemo1.java in the Demo collection). As suggested in the demo, a better way to do this would be to create a new renderer to plot mathematical functions directly by passing in an object that contains the function and the input ranges to plot. The renderer should do the necessary sampling and make intelligent decisions about how to plot it.
2. Currently, JFreeChart provides some limited interactive graphs – e.g. using click and drag to zoom in to a region, and using sliders to adjust graph scales. There is plenty of scope to make the graphs more dynamic by adding further interactive functions, but this should be done in a systematic way so that user actions (e.g. clicking, double-click, drag, etc) have consistent effects across different chart types. For this feature request, select two (different!) chart types and demonstrate how to enhance the user interactivity in a consistent way. E.g. for circular graph types (e.g. dials, pie charts, ...) click-and-drag could be used for rotation - rotate the pie, move the dial, etc. For charts that plot data series, clicking on a data point could allow the user to add a label, etc. To make this feature valuable, concentrate on functions that users are most likely to want to do with their graphs.
3. Add the ability to draw graphs and trees in JFreeChart. Add a new JFreeChart renderer type that takes data as a set of ordered pairs representing the edges of the tree/graph, and then renders this, with appropriate choices for shape and size of graph/tree nodes selected by the user. Note: for implementation of this feature, find and use an existing (open source) graph/tree renderer that can be integrated with JFreeChart.
4. Define a new concept of a ‘chartbook’ that consists of a set of chart ‘pages’, each of which can contain a different chart. Allow a developer to first define such a chartbook by adding pages that describe the chart type, its parameters and dataset for the given page. Also, define appropriate global configuration items, such as whether there should be page numbers, a header page, a navigable contents listing, etc. Then ask JFreeChart to render the whole chartbook.

## III. What to Hand In

Hand in your report at the start of your tutorial on the due date. *Reports not handed in within the first ten minutes of the tutorial will be treated as late.*

The report should not exceed twenty (20) pages (not counting cover pages and appendices). All detailed diagrams should be included as appendices, but they should be summarized in the main body of the report, with enough commentary for the reader to understand what you did, and what the appendices show.

Your submitted report should include the following items:

1. A brief description of the rationale for your choice of feature to implement.
2. A requirements analysis for the selected feature. Your analysis should clearly distinguish between user requirements (e.g. goals) and the specific functions to be implemented, and indicate any assumptions needed to ensure that these functions will indeed satisfy the requirements. Include any models (e.g. domain models, goal models) that you created to help you in the analysis.
3. A complete set of use cases for the selected feature. Your use cases should show alternative paths and exceptional behaviours, and document pre- and post-conditions for each use case.

4. A robustness analysis for the selected feature. Your analysis should clearly indicate which classes already exist in the current version of JFreeChart, and which will have to be added. It should also clearly show how use cases map onto these classes.

### Written Presentation Requirements

Be sure to include a cover page indicating the name of your team, the names of all team members, title of work, course, date and tutor's name. Assignments will be judged on the basis of visual appearance, the grammatical correctness and quality of writing, and the visual appearance and readability of the models, as well as their contents. Please make sure that the text of your report is well-structured, using paragraphs, full sentences, and other features of a well-written presentation. Use itemized lists of points where appropriate. Text font size should be either 10 or 12 point.

## IV. Marking Scheme

Your tutor will mark your assignment. If you have questions about a marked assignment, you should first ask your tutor before/after a tutorial. If you don't get satisfactory answers, you should talk to your instructor.

Marks for this assignment will depend on the following factors:

**Description of your choice of feature to implement (20%):** Did you clearly describe the criteria you used for your decision? Are the criteria appropriate? Is the choice sensible, given the criteria? Did you investigate existing resources (e.g. libraries, open source code, etc) that you could use to implement the features? Did you use appropriate tools such as estimation and risk analysis to help make the decision?

**Description of your requirements analysis (20%):** Did you analyze the requested feature from the user's perspective? Did you clearly distinguish between the user's goals and the functions that the software will provide? Is your list of required functions complete and appropriate? Did you set out a clear argument for why the specified functions will meet the user's goals? Did you make appropriate use of goal models and domain models to support this argument? Did you identify any domain assumptions used in these analyses?

**Description of your use cases (20%):** Did you identify an appropriate set of use cases for the requested feature? Did you draw a Use Case diagram? Are your use cases written from the users' perspective? Would the use cases be suitable as the basis for a user manual? Did you clearly document the normal and alternative paths for each use case? Did you identify exceptions? Did you identify pre- and post-conditions for each use case? Did you identify relationships between use cases (e.g. "uses", "extends") where appropriate?

**Description of your robustness analysis (20%):** Did you complete a robustness diagram for each major use case? Does your robustness diagram correctly distinguish boundary classes, control classes and domain classes? Does your robustness diagram indicate which classes will be newly added, and which already exist?

**Presentation (20%):** The style of your presentation, including language, grammar, clarity of the presentation, layout and legibility of the diagrams, etc. (10% - Language; 10% - Style and clarity)

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