

Name: \_\_\_\_\_

**Final Exam CS 498, Section 1**

**May 3, 2007**

**Read and follow the directions for each question. There are ten questions (A-J) with a total credit of 200 points. There is one extra credit question (K) worth 20 points, but you cannot get more than 200 points. Textbooks, other notes or materials, talking to other students, and devices with memory or communication capabilities (such as laptops, cell phones) are not allowed, and their use constitutes academic dishonesty.**

**A. Process (25 points)**

Requirements capture is often considered the most important phase of the software development process. It is claimed that bugs in requirements are more expensive to fix than any other bugs.

- a) Give an example of a requirements bug, and explain how it would increase cost.
- b) What happens in a project if requirements capture is not done properly? Outline the consequences for design, implementation, and testing.
- c) Sometimes customers change their minds about requirements in the project or they are not sure about the requirements and give very vague descriptions of their needs. Why is this a problem? What can developers do to avoid problems caused by vague or changing requirements?
- d) Give an example from your own experience illustrating the situation in c.

**B. Class Design (25 points)**

- a) What issues does class design deal with? Name three questions that should be answered by the design of a class.
- b) Why is it important to design classes well?
- c) Name three principles of class design, and give the rationale for each.
- d) What is the relationship between class design and coding conventions? Describe what distinguishes the two, and what they have in common.

**C. Refactoring (10 points)**

- a) Define refactoring.
- b) Give an example of a refactoring. Give an outline of the steps involved.
- c) Explain the relationship between refactoring and unit testing.
- d) What happens to a program that is never refactored? Justify your answer. Give specific examples of problems that will likely occur.

**D. Regression testing (10 points)**

- a) Define regression testing.
- b) Explain why regression testing is important.
- c) Is regression testing part of unit testing, part of system testing, or both? Justify your answer.

**E. Bug Tracking (15 points)**

- a) Name a bug tracking system.
- b) Describe the typical features of a bug tracking system.
- c) List the different actors that use a bug tracking system, and explain for what purpose each of them uses it (hint: there are at least three).

**F. Human-Computer Interaction (15 points)**

- a) Define usability and learnability.
- b) Explain the trade-off between usability and learnability.
- c) Give an example of a program that is learnable, but not very usable. Explain, and point out specific features that affect usability and learnability.

**G. Human-Computer Interaction (20 points)**

- a) Name your favorite text editor and discuss whether you think its user interface is well designed.
- b) Name five user interface design principles, and give for each an example of how it is (or is not) implemented by your favorite editor.
- c) State whether your favorite editor has a graphical or a textual interface. Give two advantages and two disadvantages of this solution.

## **H. Project Management (35 points)**

- a) What is the role of the project manager in a software development team?
- b) List three activities (other than the one mentioned below) that are typically done by the project manager, and explain for each why this activity should be done by one designated person and not by everyone in the team.
- c) Project managers are often required to create a risk analysis. Explain what a risk analysis (or risk plan) is.
- d) List three specific risks that could be part of the risk analysis of a typical software project.
- e) What is the purpose of a risk analysis?
- f) Explain what a personmonth is, and how it is used.
- g) Why are personmonths in software development considered "mythical"?

## **I. Intellectual Property Law (25 points)**

You are working for a company that develops and operates a shopping Web site. You notice a competitor's site that looks very similar. It has a similar Gui, a similar workflow, a similar recommendation system, and even a similar name. Looking at the HTML source, you also notice that it was developed with the same Web development tool.

- a) Name and define each of the four categories of IP law.
- b) From the point of view of intellectual property law, what should you do in this situation? For each of the categories of IP law, discuss what you should do next. Keep in mind that, before filing a law suit, one should collect evidence to support one's position.

**J. Capstone Project (20 points)**

a) What was the biggest difficulty in the capstone project for you and your team? Explain the problem, and how you managed to overcome it.

b) If you had to do the same project again, what would you do differently? Name at least three things.

**K. Design (20 points of extra credit)**

It is considered useful to know if certain objects are immutable (i.e., they cannot be changed once created).

- a) Why is it good to specify that an object is immutable; what benefits do designers and coders have if they know that a certain object can never be changed? List at least two benefits.
- b) Explain how a class hierarchy should be designed to accommodate both a mutable and an immutable version of a class, for example a `MutableList` and an `ImmutableList`. Describe the solution, and discuss its benefits.