University College Dublin
An Coláiste Ollscoile, Baile Átha Cliath

SEMESTER 2 EXAMINATION – 2011/2012

COMP 30160

Object-Oriented Design

Prof. Alain Mille
Mr. J. Dunnion
Dr. Mel Ó Cinnéide*

Time Allowed: 2 hours

Instructions for candidates

Answer any three questions.

All questions carry equal marks.

© UCD 2011/12 Modular

Question 1

Write an essay entitled "Current Practice in Software Development."

Your essay may cover a range of topics including, but not limited to: the Unified Process, Agile Processes, Testing, Refactoring, Software Quality, Design Patterns. You may choose to focus on certain areas, and ignore others. Feel free to put forward any viewpoint you wish (e.g. pro- or anti- Agility), once your position is based on solid argument. You need not limit your essay to what has been covered in this module.

Your overall goal in writing this essay is to try to convey that you have a broad and nuanced understanding of software development.

(20 marks)

Question 2

(a) Explain, using examples, the following Object-Oriented Design principles. Include in your answer the motivation for the principle and what the consequences are if the principle is not observed.

(i) Open-closed principle
(ii) No concrete superclasses principle
(ii) Law of Demeter

(10 marks)

(b) What is a code smell and how are they used in software development? For each of the following code smells, describe the smell and explain the range of refactorings you would consider performing in order to remove the smell:

(i) Feature Envy
(ii) Primitive Obsession
(ii) Speculative Generality
(iv) Duplicated Code
(v) Refused Bequest

(10 marks)

Question 3

(a) Describe briefly each of the principal UML models, viz:

Use Case model
Class model
Interaction model

Explain the purpose of each of these models when analysing using UML, and explain how these models relate to each other. What aspects of a system *cannot* be described using these models?

(10 marks)

(b) In relation to the **Factory Method** design pattern, answer the following:

(i) State the intent of the pattern

(ii) Provide a motivating example for the pattern (including UML class model)

(iii) Explain what a static factory method is

(iv) Explain how the factory method pattern can be used to connect parallel class hierarchies

(v) How might Lazy Instantiation be used in the implementation of this pattern?

(10 marks)

Question 4

(a) Distinguish between white-box and black-box testing. Draw a Control Flow Graph (CFG) for the following method. Provide three sets of test cases, each providing a different level of code coverage, namely (i) statement coverage, (ii) modified condition/decision coverage and (iii) path coverage.

```
        boolean foo(int i, int j){
1           if (i<=0 || j>100)
2               System.out.println("...");
3           while(i>0 && j<100){
4               i=i/2;
5               j++;
6           }
7           return j==100;
8       }
```

(10 marks)

(b) Describe how to do Test-Driven Development (TDD) using JUnit. Explain carefully what the developer does in each phase. What are the benefits and drawbacks of this approach? What is your opinion on the merits of TDD?

(10 marks)