

EXAMINATIONS – 2013
Trimester 1

SWEN423
OBJECT-ORIENTED
PARADIGMS

Time Allowed: 3 Hours

Instructions:

- Open book.
- This examination will be marked out of **180** marks.
- Read each question carefully before attempting it.
- Answer all six questions. Each question has the same value, and should take approximately 30 minutes to answer.
- You may answer the questions in any order. Make sure you clearly identify the question you are answering.
- Many of the questions require you to discuss an issue, or to express and justify an opinion. Be careful in how you answer: is important to both show that you *understand* the topic but also that you can *explain* it properly *using accurate terminology*.
- Your answers need only refer to the topic discussed in the course, but you may refer to other topics if you wish.
- Non-electronic foreign language-English dictionaries are permitted.
- Non electronic student notes are permitted, including annotated SWEN423 books.
- No calculator permitted.

Question 1. Method dispatch

[30 marks]

(a) [9 marks]

Define the concept “statically dispatched method”.

Define the concept “single dispatched method”.

Define the concept “multiple dispatched method”.

(b) [6 marks]

Explain the difference between multiple dispatch and overloading (overloading as defined in Java).

(c) [15 marks]

Motivate the utility of statically dispatched, single dispatched and multiple dispatched methods. Answer explicitly the following points:

- What is the utility of statically dispatched methods?
- What is the utility of single dispatched methods?
- What is the utility of multiple dispatched methods?
- What is the utility of single dispatched methods where the dispatch decision is not made on the first argument?
- From a language design perspective, is there any possible disadvantage in supporting multiple dispatched methods? justify your answer.

Question 2. Frameworks and traits

[30 marks]

A software company have created an object oriented, nominally typed Java-like language called *CIT*. It contains Java-like classes and interfaces, however there are two main differences:

- Traits are present in the language, as the only mechanism to obtain code reuse. The offered trait composition operators are the same as found in the paper “Traits: Composable Units of Behaviour”,
- classes are all implicitly declared final,
- and interfaces are the only mechanism to obtain subtyping.

In your answer explain how the three main features of CIT (interfaces, final classes and traits) can be used in the design of frameworks. Use examples to keep your presentation concrete.

Question 3. Aspect Orientation and Active libraries

[30 marks]

(a) [10 marks]

Discuss aspect orientation and active libraries as language mechanisms, i.e. focus on what they do and not what they are good for.

(b) [10 marks]

Compare and contrast these two language mechanisms: what problems can be attacked (more) easily with AOP (with respect to Active Libraries)?

(c) [10 marks]

Compare and contrast these two language mechanisms: what problems can be attacked (more) easily with Active Libraries (with respect to AOP)?

Question 4. Smalltalk-Newspeak-Java

[30 marks]

Smalltalk and Newspeak are two different languages, but they are quite similar when compared with Java. Focusing on the similarity between Smalltalk and Newspeak compare/contrast them with Java; that is, you do not need to address minor differences but to explicitly identify the major ones and focus on them.

Use examples to keep your presentation concrete.

Question 5. Immutability

[30 marks]

(a) [5 marks]

What is the difference between an immutable class and an immutable object?

(b) [12 marks]

Compare advantages and disadvantages of deep immutability with respect to shallow immutability.

(c) [13 marks]

From the user perspective, describe the difference between calling a library method whose return type is mutable (as for normal Java references), read-only or immutable, respectively.

Question 6. Expression problem

[30 marks]

We have seen many different ways to solve the expression problem:

(a) [8 marks]

Briefly in at most 2 or 3 sentences, explain what the expression problem is.

(b) [6 marks]

List all the techniques that can be used to solve this problem.

(c) [16 marks]

Discuss the advantages and disadvantages of the various solutions.
