

OLLSCOIL NA hÉIREANN  
THE NATIONAL UNIVERSITY OF IRELAND, CORK  
COLÁISTE NA hOLLSCOILE, CORCAIGH  
UNIVERSITY COLLEGE, CORK

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Semester 2 — Summer Exam 2017

CS2514 Introduction to Java

**EXAMINERS**

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**DURATION**

1.5 hours

**INSTRUCTIONS**

Answer **all 4** questions for full marks (80). There is **no need** to write whole classes *unless the question requires you write a class*. There is **no need** to write import statements. Use meaningful identifier names, pay attention to the layout, and make sure your coding style is clear. There is **no need** to provide comments, *unless the question requires you provide comments*.

**SPECIAL INSTRUCTIONS**

The use of calculators, books, notes, and crib sheets is *not* allowed.

PLEASE DO NOT TURN THIS PAGE UNTIL INSTRUCTED TO DO SO.  
ENSURE THAT YOU HAVE THE CORRECT PAPER.

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**Question 1: Objects and Classes.****(20/80 marks)****Question 1.a.****(4 marks)**

Using two sentences only, please define object state and object behaviour.

**Question 1.b.****(6 marks)**

How do you implement object state and object behaviour?

**Question 1.c.****(10 marks)**

Consider a class Example that defines a class attribute attribute, which is an int. Why can't this attribute represent object state?

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**Question 2: Inheritance.****(20/80 marks)****Question 2.a.****(5 marks)**

What is inheritance?

**Question 2.b.****(6 marks)**

State three, and no more than three, advantages of inheritance.

**Question 2.c.****(9 marks)**

Provide a concrete example of how you may implement inheritance in Java. Explain your example in terms of the notions of 'being more specific' and 'being more general' and relate these notions to the notions of *is-a*, *extension*, *subclass*, and *superclass*. **There is no need to provide Java code.**

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**Question 3: Enumerated Types.****(20/80 marks)**

Java Joe's claim to fame is a scientific calculator, which he implemented in Java using the int enum anti-design pattern. Each button on Joe's calculator corresponds to a binary operation and each button has its own printable operator symbol.

**Question 3.a.****(10 marks)**

Provide an enumerated class for the buttons on the calculator. The class should define a method for printing the operator symbol and a method for applying the binary operation. For simplicity you may assume that adding and subtracting are the only allowed button operations.

**Question 3.b.****(10 marks)**

Provide three reasons why your design is better than Java Joe's class.

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**Question 4: Generics.****(20/80 marks)****Question 4.a.****(2 marks)**

What is a generic class?

**Question 4.b.****(2 marks)**

Provide code for a declaration of a variable with a generic type from an existing class and a meaningful value to the variable.

**Question 4.c.****(6 marks)**

Provide two advantages of generic classes. For each advantage you should provide a concrete example with Java statements that illustrates the advantage.

**Question 4.d.****(10 marks)**

The Reference class is designed for representing object references, *which may change over time*. Provide a generic class definition for the Reference class.