f

Midterm Examination: Semester 1   **Academic Year**: 2009-2010

Date: 29th July, 2009   **Time**: 9:00 – **11:00 (2 hours)**

Subject Number: 240-321   **Rooms**: A400

Subject Title: Advanced Programming Techniques (OOP)

Lecturer: Aj. Andrew Davison

Exam Duration: 2 hours

This paper has 3 pages.

Authorized Materials:

- Writing instruments (e.g. pens, pencils).
- Books (e.g. dictionaries) and calculators are **not** permitted.

Instructions to Students:

- *Answer questions in English.* Perfect English is **not** required.
- Attempt all questions.
- Write your answers in an answer book.
- Start your answer to each question on a new page
- Clearly number your answers.
- Any unreadable parts will be considered wrong.
- When writing programs, use good layout, and short comments; marks will not be deducted for minor syntax errors.
- The marks for each part of a question are given in brackets (...).

Question 1   (30 marks; 30 minutes)

a) Explain the differences between a *class* and an *object*? (13)

b) Explain *call-by-value* and *call-by-reference* parameter passing in Java. (12)

c) Explain the differences between the String and StringBuilder classes. (5)

Explain using words, diagrams, and **small** code fragments in your answers.

Question 2   (35 marks; 35 minutes)

a) Write a Java student class which stores a student's name, student number, and year of study. There should be methods for accessing the name, number, and year, and a method for changing the year value. There should also be a toString() method which returns the student details as a single String. All the data in the class should be private. (10)

b) Write a short TestStudent class that shows how a student object can be created and used. (5)

c) Write a subclass of student called PostgradStudent. It should include data on the student's thesis and department, and methods for getting and setting those values. There should also be a toString() method. All the data in the class should be private. (7)

d) Write a short TestPostgradStudent class that shows how a PostgradStudent object can be created and used. (3)

e) Explain **two** programming techniques which allow code in PostgradStudent to directly access and change the data inherited from student. Explain which of these techniques is better. (10)

Question 3   (40 marks; 40 minutes)

a) Write a BankAccount class which stores a bank account number and the current balance. There should be methods to deposit and withdraw money, to get the current balance, and account number. (15)

b) Write a Bank class that stores a collection of bank accounts. (15)

c) What are *loose coupling* and *cohesion*? Explain how these concepts apply to the BankAccount and Bank classes if their data is public, or private. (10)

Q.4 on Next page.

Question 4   (15 marks; 15 minutes)

a) Write a main() program that uses Java's Random class to create an ArrayList of randomly generated *integers*, which have values somewhere between -5 and 5.

   The number of integers to be generated is supplied by the user inputting the number when prompted by the program. *Hint*: use Java's Scanner class. (5)

b) Does part (a) have to use an ArrayList, or could an array be utilized? Explain your answer in words. (10)

--- End of Examination ---