NUI Galway
OÉ Gaillimh

Semester 1 Examination 2015 / 16

Exam Code(s)	3BCT1, 3BS9, 1EM1, 1SWB1
Exam(s)	3rd B.Sc. Computer Science and Information Technology 3rd Bachelor of Science 3rd B.Sc. (Information Technology) Erasmus Science Without Borders
Module Code(s)	CT331
Module(s)	Programming Paradigms
Paper No.	1
Repeat Paper	
External Examiner(s)	Dr. John Power
Internal Examiner(s)	Prof. Gerard Lyons Dr. Michael Madden Dr.EndaHowley* Dr.ColmO'Riordan*
Instructions:	Candidates should answer **Three** questions, with at least one from each section. Each section should be answered in a separate answer book. All questions carry equal marks.
Duration	2 hours
No. of Pages	3

Requirements:
MCQ
Handout
Statistical/ Log Tables
Cambridge Tables
Graph Paper
Log Graph Paper
Other Materials

Release to Library: Yes ☐ No ☐

SECTION A

Q. 1

(a) Write a tail recursive scheme function that reverses a list of items. Note that if a sub-list is encountered, the contents of the sub-list do not need to be reversed. **(7)**

(b) Describe what is meant by a *higher order function* in scheme. Write a higher order function that can sum together a list of numbers such that only numbers that satisfy some criterion specified in a separate function are included in the summation.

For example the following function should only sum together the odd numbers.

(sum odd? '(3 4 5 6 8)) should return 8. **(8)**

(c) Show how a binary search tree can be represented in Scheme. Outline functions, in Scheme, to:

i) Search the binary search tree for a value
ii) Insert a value into the binary search tree. **(10)**

Q.2

(a) Explain what is meant by a push-down automaton (PDA) by drawing a PDA and any associated data structures to recognise strings of the form 1^n0^n, i.e., any sequence of 1's of length n, followed by a sequence of 0's of the same length n. Illustrate how the PDA works with suitable examples. **(8)**

(b) Write Prolog code that counts the number of occurrences of an item in a list. **(8)**

(c) Write Prolog code to merge two lists, sorted in ascending order, into a single list. Note that there should be no duplicates in the final list. **(9)**

SECTION B

Q.3.

(a) Outline the main benefits and features of using the Object Oriented Paradigm? **(3)**

(b) With the aid of suitable examples (including code), explain each of the following OO concepts using examples from C#:

- Inheritance,
- Polymorphism,

(10)

(c) Outline the core concept behind delegates in C#, and with the aid of a suitable code implementation show how they can be beneficial? **(12)**

Q.4.

(a) With the aid of code examples, outline the differences between a *class* and a *struct*? **(5)**

(b) With the aid of a suitable example, show how you would implement all of the following: **(10)**

- A full Interface Implementation
- Interface Inheritance
- A Class that implements Multiple Interfaces
- *explicit* and *implicit* interface implementations.

(c) Show with the aid of code, how you would implement the following in C# with the given database table *Students*: **(10)**

- Instantiate the SqlConnection.
- Open the connection.
- Pass the connection to other ADO.NET objects.
- Insert a new row of data into the *Students* table
- Delete a row of data from the *Students* table
- Update some existing data in the *Students* table
- Close the connection.

Table: Students

Student_ID	Student_Name	DOB	Address
00000001	Mary Murphy	1/1/1985	Newcastle, Galway
00000002	John Smith	5/3/1987	Salthill, Galway
00000003	Joe Franks	8/2/1990	Barna, Galway