



Semester 1 Examination 2014

Exam Code(s) 3BCT1, 1EM1, 1SWB1,
Exam(s) 3rd B.Sc. Computer Science and Information
Technology
3rd B.Sc. (Information Technology)
Erasmus
Science Without Borders

Module Code(s) CT331
Module(s) Programming Paradigms

Paper No. 1
Repeat Paper

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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 Scheme function, *count_occur* that counts the number of times an item occurs in a list of items; note that the list may contain sub-lists and you should also count occurrences in those sub-lists.

The function should take an item and a list as arguments. For example:

(count_occur 2 '(4 7 2 (4 2) 2)) should return 3.

(7)

- (b) Describe what is meant by a *higher order function* in Scheme. Write a higher order function, *filter*, that can filter items from a list according to some criteria defined in a separate function (for example, *even?*). You may assume the list does not contain sub-lists.

(filter even? '(2 4 5 6 7)) should return *(2 4 6)*.

(8)

- (c) A *2-3 tree* is a generalisation of a binary search tree. In a *2-3 tree*, each node contains two values and three pointers to subtrees. The values in the node are sorted and the search tree properties hold for all sub-trees. Suggest a representation for *2-3 trees* in Scheme and outline scheme code to display the contents of 2-3 tree in sorted order.

(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) Using a list representation for sets, write Prolog code for the two following predicates:

- i) *member(X,L)* which is true if and only if X occurs in L
- ii) *subset(K,L)* which is true if and only if K is a subset of L

(9)

- (c) Explain what is meant by the term *tail-recursive*. Write Prolog predicates to reverse a list. Comment on whether your predicates are tail-recursive.

(8)

SECTION B

Q.3.

- (a) Outline the main benefits and features of using an Object Oriented Paradigm? (3)
- (b) With the aid of suitable examples (including code), explain each of the following OO concepts using examples from C#:
- Objects,
 - Methods,
 - Inheritance,
 - Polymorphism,
- (12)
- (c) Outline the core concept behind delegates in C#, and with the aid of a suitable code implementation show how they can be beneficial? (10)

Q.4.

- (a) Outline the main features of the .NET development environment. (5)
- (b) Show with the aid of code, how you would implement the following in C# with the given database table *Students*: (20)
- Instantiate the SqlConnection.
 - Open the connection.
 - Pass the connection to other ADO.NET objects.
 - Insert 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