CS103 Machines, Languages and Computation

Workbook for Assignments 4 and 5, Semester 1, Weeks 5 and 6

Version 1, October 26th 2015

Name:

Matriculation number:

Degree course:

This workbook contains Assignments 4 and 5 for CS103 Machines, Languages and Computation in Semester 1.

Assignments 1-3 are in the first workbook.

You should attempt all five assignments before the class test, which will be on Friday 30th October 2015 at 10am.

Keep this workbook – when you've filled it in with your answers, you can use it as a revision aid for the class test.

The Class Test

The Class Test will contain five questions, one on each assignment. You are asked to attempt all five questions. Each question is marked out of 20.

The questions will be directly related to the assignments in the workbooks.

Assessment Structure

Your final mark for this class will be 7.5% for each of the four class tests and 70% for the 2 hour degree exam in May/June 2015.

If you pass all four class tests (with 40% or more in each) and achieve an average of more than 60%, then you will be exempted from the degree exam. Your final mark for the class will be your average mark in the four class tests.

Assignment 4: Functions and Mappings

Consider an infinite set of dogs. Each dog has a name, which is a finite string of letters (all in uppercase), such as "FIDO" or "GROMIT".

Consider an infinite set of collars, where every collar is labelled with an integer n which is member of the set of natural numbers $\{0, 1, 2, 3 \ldots\}$.

(a) Using the mapping suggested in Lecture 9, what collar does "ODIE" get?

(b) What is that name of the dog that gets collar number 106503?

Assignment 5: Infinite Sets and Cardinality

All sets are either finite or infinite, and all infinite sets are either countable or uncountable.

(a) Define what is mean by a *finite set*.

(b) Define what is mean by an *infinite countable set*.

(c) Define what is meant by an *infinite uncountable set*.

(d) Label each of the following sets as finite or infinite, and then label the infinite sets as either countable or uncountable:

[Note: N is the set of natural numbers $\{0, 1, 2, 3, \ldots\}$]

  (i) the set of all students taking CS103

  (ii) the set of all theorems of the MIU system

  (iii) the set of all the prime numbers

  (iv) the set $\{n \mid n \in N \text{ and } n < 5\}$,

  (v) the set of all the real numbers

  (vi) the set of all dogs with four letter names

  (vii) the set of all possible subsets of N

  (viii) the set of all computer programs

  (ix) the set of all functions from $N \rightarrow N$