

CSU12002 Homework I

This homework is an individual assignment. It will be marked out of 25.

Please write your **NAME** and **CSU12002** on the top of the first page.

Submit your solution online via the CSU12002 page on mymodule.tcd.ie.

Your assignment should be submitted by **8pm on Monday, 28th February**.

- To obtain full marks you will need to lay your work out in clear logical steps. Show **ALL** of your arguments and workings. If asked to provide a proof you need to include all of the information needed for a formal proof.
- Plagiarism is considered as academically fraudulent, and an offence against University discipline. The University considers plagiarism to be a major offence, and subject to the disciplinary procedures of the University.

Q1 (5 marks)

Let n be an integer. Give a proof of the following statement:

If n is a multiple of 10 then n^2 is a multiple of 4.

Q2 (8 marks)

- (a) Prove the following statement is true for all integers n using proof by contraposition.

If $n^2 + 4n + 5$ is odd, then n is even.

- (b) Hence, prove that the following statement is true for all integers n :

$n^2 + 4n + 5$ is odd if and only if n is even.

Q3 (5 marks)

Prove that the following inequality is true for all real numbers x by using a sequence of IFF statements and justifying each step in your proof.

$$x^6 \geq 4x^3 - 4$$

Q3 (8 marks) For each of the following statements define suitable predicates and express them using quantifiers and logical operators. Let the universe of discourse be the set of all students taking CSU12002.

- (a) A student taking CSU12002 owns a laptop, a phone and a calculator.
- (b) All students taking CSU12002 own a laptop, a phone and a tablet.
- (c) Some student taking CSU12002 owns a tablet and a phone, but not a laptop
- (d) For each of the three devices (laptops, tablets and phones) there is a student taking CSU12002 who owns one of these devices.

Homework Submission: Submit your work as a **SINGLE PDF FILE**. Please submit handwritten work that you have scanned or taken photos of. Remember to combine your scanned files into a single pdf if necessary. Typeset work (e.g. that created using LaTeX or Microsoft Word with equation editor) will only be allowed in exceptional circumstances – please email Meriel.Huggard@tcd.ie to obtain permission to typeset your work.