

# Assignment 1

## CSCI 3110: Design and Analysis of Algorithms

Due May 22, 2018

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Assignments are due on the due date before class and have to include this cover page. Plagiarism in assignment answers will not be tolerated. By submitting their answers to this assignment, the authors named above declare that its content is their original work and that they did not use any sources for its preparation other than the class notes, the textbook, and ones explicitly acknowledged in the answers. Any suspected act of plagiarism will be reported to the Faculty's Academic Integrity Officer and possibly to the Senate Discipline Committee. The penalty for academic dishonesty may range from failing the course to expulsion from the university, in accordance with Dalhousie University's regulations regarding academic integrity.

**Question 1 (8 marks)** Prove the following statements using the definition of  $\Theta$ -notation, that is, by choosing constants  $c_1, c_2, n_0$  that satisfy the condition in the definition.

(a)  $8n^3 + 5n^2 + 12\sqrt{n} - 10n \log n \in \Theta(n^3)$

(b)  $n \log n + 13n - 40 \log n \in \Theta(n \log n)$

**Question 2 (15 marks)** Sort the following functions by increasing order of growth:

$$(4/3)^{\log n} \quad n \log n \quad 3^n \quad n \quad 4^{\log \log n} \quad \sqrt{n}$$

If your list is  $f_1(n), \dots, f_6(n)$ , then, for all  $1 \leq i < 6$ , use limits to prove that  $f_i(n) = o(f_{i+1}(n))$ .