DAA (Design and Analysis of Algorithms)

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Assignment: 01 (Asymptotic Notations)

Submitted to: **Sir Farooq Zaidi**

Question:

Proof (and explain that proof) the 4 statements in the PDF attached. Revise DM to understand how you prove or disprove a statement. Do the assignment in groups and discuss among your peers. Type your proof using Microsoft Word equations tools and export it as PDF. Save the PDF in your GitHub repository in a folder named "Assign01"

1. $7n - 2 = O(n)$

Proof:

$F(n) \leqslant cg(n)$ $\quad for\ all\ n \geqslant K$

$F(n) = 7n - 2$

$g(n) = n$ $\quad c = 7$

$7n - 2 \leqslant 7n$

$n = 1$

$7(1) - 2 \leqslant 7(1)$

$5 \leqslant 7$ $\quad \forall\ n \geqslant 1$

$n = 2$

$7(2) - 2 \leqslant 7(2)$

$12 \leqslant 14$ $\quad \forall\ n \geqslant 1$

Proved !!!

2. $7n - 2 = \Theta(n)$

Proof:

$c^1 g(n) \leqslant f(n) \leqslant c^2 g(n)$ $\quad for\ all\ n \geqslant K$

$f(n) = 7n - 2$

$g(n) = n$

$c_1 = 5$

$c_2 = 7$

$5n \leqslant 7n - 2 \leqslant 7n$ $\quad \forall\ n \geqslant K$

$n = 1$

$5(1) \leqslant 7(1) - 2 \leqslant 7(1)$ $\quad \forall\ n \geqslant 1$

$5 \leqslant 5 \leqslant 7$ $\quad \forall n \geqslant 1$

$n = 2$

$5(2) \leqslant 7(2) \leqslant 7(2)$ $\quad \forall\ n \geqslant 1$

$10 \leqslant 12 \leqslant 14$ $\quad \forall n \geqslant 1$

Proved !!!

3. $7n - 2 = \Theta(n^2)$

Proof:

$c_1 g(n) \leqslant f(n) \leqslant c_2 g(n)$

$f(n) = 7n - 2$

$g(n) = n^2$

$c_1 = 5$

$c_2 = 7$

$5n^2 \leqslant 7n - 2 \leqslant 7n^2$

$n = 1$

$5(1)^2 \leqslant 7(1) - 2 \leqslant 7(1)^2$

$5 \leqslant 5 \leqslant 7$

$n = 2$

$5(2)^2 \leqslant 7(2) - 2 \leqslant 7(2)^2$

$20 \leqslant 12 \leqslant 28$

Not Proved !!!

(Because this is **transpose symmetric property** this property only satisfies for **O** and ***Ω*** notation, not for **Θ** notation.)

4. $3n^3 + 20n^2 + 5 = O(n^6)$

Proof:

$3n^3 + 20n^2 + 5 \leqslant c(n^6)$

$(3n^3 + 20n^2 + 5) / n^6 \leqslant c$

$n = 1$

$(3\ (1)^3 + 20\ (1)^2 + 5) / 1^6 \leqslant c$

$28 \leqslant c$

$n = 2$

$3(2)^3 + 20(2)^2 + 5 \leqslant 28(2)^6$

$24 + 80 + 5 \leqslant 1792$

109 ⩽1792

Proved !!!