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CST-201

Green Group

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CLC: Assignment 1: Exercise 2.11.4

**Problem:** Assume f1(n) is O(g1(n)) and f2(n) is O(g2(n)), give a counterexample that refutes the following:

1. f1(n) – f2(n) is O(g1(n) – g2(n))
2. f1(n)/f2(n) is O(g1(n)/g2(n))

**Solution for A:**

Step 1: We can replace the f(n) functions with their equivalent Big O representations. Also make the right side of the equals into the law of addition format to get:

O(g1(n)) - O(g2(n)) ?= O(g1(n) + (– g2(n)))

Step 2: We can take it back a step out of the law of addition, so we can see what terms can be eliminated from each side:

~~O(g~~~~1~~~~(n))~~ - O(g2(n)) ?= ~~O(g~~~~1~~~~(n))~~ + O(– g2(n))

Result: We find that the two sides are not equal:

-O(g2(n)) != O(– g2(n)) or O(-g2(-n) != O(– g2(n))

**Solution for B**

Step 1: Again, we replace the f(n) functions with their equivalent Big O representations. This time we make the right side follow the multiplication law format to get:

O(g1(n))/O(g2(n)) ?= O(g1(n) \* 1/ g2(n))

Step 2: Again, we can back this one step further out of the multiplication law, so we can compare like terms for elimination:

~~O(g~~~~1~~~~(n))~~/O(g2(n)) ?= ~~O(g~~~~1~~~~(n))~~ \* O(1/ g2(n))

Result: We again find that the two sides are not equal:

1/O(g2(n)) != O(1/ g2(n))

**Example for A**

Let f1(n) = n2 +2n +1 is O(g1(n2)) & Let f2(n) = 3n+4 is O(g2(n))

We then want to distribute the -1(f2(n)) to subtract.

n2 +2n +1 – 3n - 4 = n2 - n

Combine all like terms

n2 - n - 3 = n2 – n

get the result

-3 != 0

**Example for B**

Let f1(n) = n2 +2n +1 is O(g1(n2)) & Let f2(n) = nis O(g2(n))

Written out this looks like

n2 +2n +1/n = n2/n

Combine all like terms

n +2 +1/n = n

2 +1/n = 0

-2n = 1

n = -1/2

get the result

n != |-1/2| N must be positive.