Steffan Nilsson

CIS 7 - Discrete Structures - Assignment 9

Due 9/27/2017

- [ ] 2.2 Exercise 3: Prove by induction that 1 + 5 + 9 + ... + (4n-3) = n(2n-1)

Base case n = 1:

1 = (1)(2(1) – (1))

1 = (2 – 1)

1 = 1

Base case is true.

Show that n + 1 is true:

1 + 5 + 9 + … + (4n – 3) + (4(n + 1) – 3) = (n + 1)(2(n + 1) – 1)

n(2n – 1) + (4n + 4 – 3) = (n + 1)(2n +1)

2n2 – n + 4n + 1 = 2n2 + n + 2n + 1

2n2 + 3n + 1 = 2n2 + 3n + 1

n + 1 is true so all values of n are true.

- [ ] Prove that for any positive integer number n, n3 + 2n is divisible by 3

n3 + 2n = 3m

Assume n = 1:

13 + 2 = 3m

3 = 3m

m = 1

3 = 3

Base case true.

Show n + 1 is true:

(n + 1)3 + 2(n + 1) = 3m

n3 + 3n2 + 5n + 3 = 3m

(n3 + 3n2 + 5n + 3) / 3 = m

n3 + 3n2 + 5n + 3 = 3((n3 + 3n2 + 5n + 3) / 3)

n3 + 3n2 + 5n + 3 = n3 + 3n2 + 5n + 3

- [ ] Prove that for n >= 1, 9n − 1 is divisible by 8 for all non-negative integers

Hint: 4(3+1) = 4 \* 43

Hint: If 9n - 1 = 8m, then 9n = 8m + 1

Assume n = 1:

91 – 1 = 8m

9 – 1 = 8m

8 = 8m

m = 1

8 = 8(1)

8 = 8

Base case true.

Show n + 1 is true:

9(n + 1) – 1 = 8m

9(n + 1) = 8m + 1

(n + 1)ln(9) = ln(8m + 1)

n + 1 = ln(8m + 1) / ln(9)

n = ln(8m + 1) / ln(9) – 1

9ln(8m + 1) / ln(9) = 8m + 1

ln(8m + 1) / ln(9) \* ln(9) = ln(8m + 1)

ln(8m + 1) = ln(8m + 1)

n + 1 is true. All values of n >= 1 are true.