ID: 03
Name: Al-Naji, Nader

Collaborator #1: Last Name, First Name
Collaborator #2: Last Name, First Name

Solution to TA1, Problem 1

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A degree k polynomial with integer coefficients is an expression of the form $\sum_{i=0}^{k} c_i \cdot x^i$ where coefficients c_i are integers and $c_k \neq 0$.

1. Prove that the set of all such polynomials where the degree k is fixed, is countable.

The hint suggests we use induction. We start proving that a degree one polynomial is countable and then go from there.

Let $Q(k) =$ the set of all polynomials of degree k is countable.

Base: $k = 1$

In the case where $k = 1$, we have a polynomial of the form: $c_1 \cdot x + c_0$ where c_1 and c_0 are both integers. We can count all such polynomials in the same way we counted the rational numbers. We consider all positive values of c_1 and all positive values of c_0, put them on perpendicular axes and snake around. This assures that we will eventually cover all positive pairs of c_1 and c_0. To get to the negative pairs, we simply add the negative values in between the positive values and put zero at the front without loss of generality. The following is an illustration of how we count these.

ID: 03
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Solution to TA1, Problem 2

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Solution to TA1, Problem 3

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Collaborator #1: Last Name, First Name
Collaborator #2: Last Name, First Name

Solution to TA1, Problem 4

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