Discrete Maths: Maths Olympiad

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Abstract—This book provides a collection of the international maths olympiad problems in discrete mathematics.

1. Prove that the fraction $\frac{21n+4}{14n+3}$ is irreducible for every natural number n.

2. In an n-gon all of whose interior angles are equal, the lengths of consecutive sides satisfy the relation

$$a_1 \geq a_2 \geq \ ...... \geq a_n. \qquad (2.1)$$

Prove that

$$a_1 = a_2 = \ ...... = a_n. \qquad (2.2)$$

3. Five students, A, B, C, D, E, took part in a contest. One prediction was that the contestants would finish in the order ABCDE. This prediction was very poor. In fact no contestant finished in the position predicted, and no two contestants predicted to finish consecutively actually did so. A second prediction had the contestants finishing in the order DAECB. This prediction was better. Exactly two of the contestants finished in the places predicted, and two disjoint pairs of students predicted to finish consecutively actually did so. Determine the order in which the contestants finished.

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