Abstract. Due Friday, February 10

Question 1. There are 13 cards in a bridge hand. How many ways are there to arrange them left to right?

Question 2. Prove that for any positive integer $n$, the product $n(n + 1)\ldots(n + 9)$ is always divisible by $10!$.

Question 3. How many different bridge hands are there?

Question 4. Prove by induction that the sum of the first $n$ perfect squares equals

$$\frac{n(n + 1)(2n + 1)}{6}$$

Question 5. Let $P$ be a convex $n$-gon. Prove that $P$ has

$$\frac{n(n - 3)}{2}$$

diagonals.

Question 6 – Bonus. Prove that for any $n$, the middle binomial coefficient $\binom{2n}{n}$ is even.

Question 7 – Bonus. Let $x$ and $y$ be integers and let $p$ be a prime number. Prove that the remainder of $(x + y)^p$ when divided by $p$ equals the remainder of $x^p + y^p$ when divided by $p$.

Key words and phrases. discrete, mathematics, sets, logic, combinatorics, graphs.