**Problem Set 10** **Foundations** **Due 4/26/23 by 5pm**

Four of these problems will be graded (our choice, not yours!), with each problem worth 5 points. Clear and complete justification is required for full credit. You are welcome to discuss these problems with anyone and everyone, but you must write up your own final submission without reference to any sources other than the textbook and instructor.

1. Do the Combinatorics assignment on WeBWorK, available via http://crlinwebwork2.coe.edu/webwork2/MTH-215/Combinatorics .

2. The Banana Theorem: Let A be a set with $n$ elements of $k$ different types (such that elements of the same type are regarded as indistinguishable from one another for purposes of orderings). Let $n_i$ be the number of elements of type $i$ for each integer $i$ from 1 to $k$. Then the number of different arrangements of the elements in A will be

$$\frac{n!}{\prod_{i=1}^{k}(n_i!)}.$$

3. How many distinguishable ways can the letters in the word *interconnectedness* be arranged?

4. If a jar contains seven balls, one red, three blue, and three white, and two balls are drawn at random from the jar (without replacement), what is the probability that neither ball is blue?

5. If a jar contains seven balls, one red, three blue, and three white, and two balls are drawn at random from the jar (without replacement), what is the probability that neither ball is blue if you know that the red ball is one of the two drawn?

6. $\forall y \in N, 0 + y = y + 0$.

7. $\forall x, y \in N, x + y = y + x \Rightarrow x' + y = y + x'$.

8. $\forall x, y \in N, x + y = y + x$.

9. Using the definition of $S(A)$ from section 5.6, write $S(\varnothing), S(S(\varnothing)), S(S(S(\varnothing)))$, and $S(S(S(S(\varnothing))))$ explicitly. How many elements are in each of these sets?

10. With the understanding that $0' = 1, 1' = 2, 2' = 3$, and $3' = 4$, where these are elements of a Peano system, show that $2 + 2 = 4$.