Directions: You may work to solve these problems in groups, but all written work must be your own. **Show your work**; See "Guidelines and advice" on the course webpage for more information.

- 1. Suppose that n men and n women attend a meeting. Let A be the set of all subsets of n people. (Here, there are no restrictions on gender, so A contains the set of all n men, as well as the set of all n women.)
 - (a) Determine |A|.
 - (b) For each k with $0 \le k \le n$, let B_k be the set of all subsets with k men and n-k women. Determine $|B_k|$.
 - (c) Use parts (a) and (b) to find a simple formula for $\sum_{k=0}^{n} {\binom{n}{k}}^2$. (Hint: apply ${\binom{n}{k}} = {\binom{n}{n-k}}$ to one of the two factors in ${\binom{n}{k}}^2$.)
- 2. A *bitstring* is an ordered list of zeros and ones; for example, 0110 and 10100 are bitstrings of lengths 4 and 5, respectively. As a special case, we use ε to denote the empty bitstring, which has length 0.
 - (a) Show that the set of all bitstrings of finite length is countable.
 - (b) Is the set of all bitstrings of infinite length countable? Justify your answer.
- 3. Is $\mathbb{N} \times \mathbb{N} \times \mathbb{N}$ (the set of all 3-tuples (x, y, z) with non-negative integer values) countable? Justify your answer.