

*Please turn in neat carefully written solutions to the problems. You should try to write good proofs.*

**Problem 1.** Let  $A$  be a set. A *sequence* in  $A$  is a function  $a : \mathbb{N} \rightarrow A$ . If we set  $a_k = a(k)$  for each  $k \in \mathbb{N}$  we sometimes write  $(a_1, a_2, a_3, \dots)$  or  $(a_k)_{k \geq 1}$  for the sequence  $a$ .

If  $A$  has at least 2 elements prove that the set of sequences in  $A$  is uncountable.

**Problem 2.** Let  $S$  be a set. Prove that  $S$  is infinite if and only if there is an injection  $f : \mathbb{N} \rightarrow S$ . Prove that  $S$  is infinite if and only if there is a surjection  $g : S \rightarrow \mathbb{N}$ .

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