

# MTH 331 — Homework #1 (Rough Draft)

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## Exercise 2: Finite and Countably Infinite Sets

Are the sets  $A$ ,  $B$ ,  $C$ , and  $Q^+$  finite or countably infinite.

### Set $A$

The set is

$$A = \{0, 0.01, 0.02, 0.03, \dots, 1\}.$$

This has only finitely many elements (from 0 up to 1 in increments of 0.01). If you counted them all up, there are 101 of them, so  $A$  is finite.

### Set $B$

The set is

$$B = \{0, 0.9, 0.99, 0.999, \dots, 1\}.$$

This is different from Set  $A$ , but we can list its elements in a sequence:

$$0, 0.9, 0.99, 0.999, \dots$$

This list will go on forever and every element is some natural number  $n$ . So  $B$  is countably infinite.

### Set $C$

The set includes the same type of decimals as in  $B$ , but repeated for  $1, 2, \dots$  and so on. It can still be arranged into a single infinite list, which shows that  $C$  is countably infinite.

### Set $Q^+$

The positive rationals can also be arranged into a sequence (for example, by writing them in a grid and reading diagonally). Therefore  $Q^+$  is countably infinite.