Set Theory Introduction

Srikar Mylavarapu

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Set theory is the study of sets. Which beg the question, what is a set?

A set is a collection of distinguishable elements. The elements are called either *members* or *elements*. Fundamentally, the following are sets.

Theorem 1.

Proof. For the sake of contradiction suppose $\sqrt{2}$ is rational. Write $\sqrt{2} = a/b$ with a, b positive integers with gcd 1. Then $2 = a^2/b^2$, so $a = 2k$ is even. Then $2 = 4k^2/b^2$ so that $b = 2k^2$, implying b is even. This contradicts that a, b have gcd 1. $\square$

Some random facts in a list:

- Compared with the "itemize" environment in LaTeX, itemize* has smaller separation between bullet points.
- The nth Catalan number is $C_n \overset{\text{def}}{=} \frac{1}{n+1}\binom{2n}{n}$.
- If $\pi(x)$ is the number of primes less than or equal to x, then

$$\lim_{x \to \infty} \frac{\pi(x)}{x/\ln(x)} = 1.$$

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$$\sum_{\substack{1 \le i \le 2n \\ i \text{ even}}} i = \frac{2n(n+1)}{2}.$$

Have fun on your problem sets.