Lecture 1: Welcome to EECS 203! -- ANSWERS

Handouts are not submitted or graded. They're just an optional supplement to lecture.

- Meet your classmates
  - Name & uniqname for 3 classmates?
    1. ______________________________
    2. ______________________________
    3. ______________________________
  - Something you all have in common?

    ____

- Something you'll do for self-care this semester

  ____

Answers will vary :-)

Course Logistics Cheat Sheet

canvas — Home base for the course – announcements, calendar, files, links

gradescope — Submit homeworks here (Most Thursdays, 10:00pm)

piazza — Ask clarifying questions about course content or logistics

ecoach — Personalized tool to help you succeed in 203. *Earn extra credit*

Recordings and some livestreams available if you don't want to attend in person

Textbook ("Discrete Mathematics and its Applications," Rosen, 7th or 8th edition)

Admin Form — Request accommodations for special circumstances (e.g., extended illness, etc.)

Propositions

A **proposition** is a statement about the world that has a truth value (either true or false).

Give an example of a **true** proposition:

$3 \cdot 3 = 9$ (for example)

Give an example of a **false** proposition:

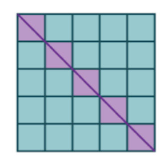
I am 217 years old (for example)

Proof 1

Definition: an integer x is even if there exists an integer k with $x = 2k$

Proposition: for any positive integer n, the number $n^2 - n$ is even.

- Consider an $n{\times}n$ grid of squares with the diagonal removed. The number of squares remaining is $\boldsymbol{n^2 - n}$.
- Let k be the number of squares remaining on either side of the diagonal.
- So $n^2 - n = 2k$ for an integer k, so $n^2 - n$ is even.



Some Proof Examples

Proposition: for any positive integer n, the number $n^2 - n$ is even.

Valid Proof 2:

Write the definition of k twice:

$$k = 1 + 2 + \cdots + (n-1)$$

$$k = (n-1) + (n-2) + \cdots + 1$$

(reversed)

$$\text{So } 2k = \underbrace{n + n + \cdots + n}_{n-1 \text{ terms}} = n(n-1) = n^2 - n$$

(add vertically adjacent terms)

So $n^2 - n$ is twice an integer k, so it is even

Some Proof Examples

Proposition: for any positive integer n, the number $n^2 - n$ is even.

Valid Proof 3:

- Using **the laws of algebra**, we can factor $n^2 - n = n(n-1)$.
- One of n and $n-1$ is even and the other is odd.
- If we multiply an even and an odd number together, we always get an even number.
- *So* $n^2 - n$ is even

12

Some Proof Examples

Proposition: for any positive integer n, the number $n^2 - n$ is even.

Valid Proof 4:

- Check the claim for $n = 1$:
  - $n^2 - n = 1^2 - 1 = 0$, and 0 is even.
- If we increase $\boldsymbol{n}$ by 1, then $\boldsymbol{n^2 - n}$ increases by $2n$.
  - $[(n+1)^2 - (n+1)] - [n^2 - n] = [n^2 + 2n + 1 - n - 1] - n^2 + n = 2n$
- If we increase an **even number** by $2n$, we get another **even number**.
- So the truth of the proposition propagates from one value of n to the next
  - If proposition is true for n, then it's also true for $n+1$.

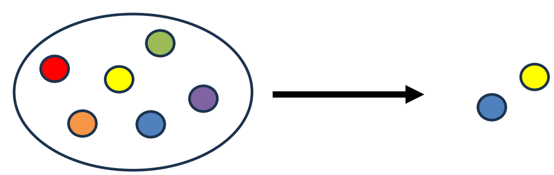
14

Some Proof Examples

Proposition: for any positive integer n, the number $n^2 - n$ is even.

Valid Proof 5:

- The formula $\frac{n^2-n}{2}$ counts the number of different ways to select two objects from among a group of n.
  - *(This is a "combination" formula, theme of last third of course.)*
- Therefore $\frac{n^2-n}{2}$ is an integer.
- So $n^2 - n$ is twice an integer, so it is even.



16