**ECS 17: Data, Logic, and Computing**

**Midterm**

**February 28, 2023**

***Notes:***

1. Midterm is open book, open notes…
2. You have 50 minutes, no more: I will strictly enforce this.
3. The midterm is graded over 70 points.
4. You can answer directly on these sheets (preferred), or on loose paper.
5. Please write your name at the top right of at least the first page that you turn in!
6. Please, check your work!

**Exercise 1 (2 parts, each worth 10 points; total 20 points)**

Let *n* be an integer. Give a **direct proof** AND an **indirect proof** of the proposition, if *n* is odd then 2*n2+5n+2* is odd.

**Exercise 2 (10 points)**

Let *m* and *n* be 2 integers. Using the method of proof of your choice, show that if *mn* is odd, then *m* is odd and *n* is odd.

**Exercise 3 (1 question, 10 points)**

Let *n* be an integer. Use a **proof by contradiction** to show that $\frac{6n+1}{2n+4}$ is not an integer.

**Exercise 4 (1 question, 10 points)**

Let *n* be a natural number (i.e., *n* is a positive integer different from 0). Use **a proof by contradiction** to show that if *n* is a perfect square, then *2n* is not a perfect square. (*A natural number n is a perfect square if and only if there exists an integer k such that n=k2*).

**Exercise 5 (1 question, 10 points)**

Let *x* be a real number. Show that if $x^{3}+x^{2}-2x<0$ then $x<1$.

**Exercise 6 (1 question, 10 points)**

Prove or disprove that there exits an integer *n* such that $n^{2}+3n+2$ is odd.

**Appendix**

