1. (0 points but please DO IT) What is your name?

2. (30 points) Fill in $XXX(n)$ and PROVE the following USING the technique of partitioning the square by superimposing a $n \times n$ grid on it (so into $n^2$ squares).

   For every set of $n^2 + 1$ points in the unit square there exists two points that are $\leq XXX(n)$ apart.
3. (35 points) Fill in $YYY(n)$ and PROVE the following USING the technique of partitioning the square by superimposing a $4 \times 4$ grid on it, and getting lots of points in that region, and then superimposing a $4 \times 4$ grid on that region, etc.

For every set of $2^n + 1$ points in the unit square there exists two points that are $\leq YYY(n)$ apart (you can assume $n$ is odd or even as you see fit).
4. (30 points) Fill in ZZZ and PROVE the following.

For any 3-coloring of the 4 × ZZZ grid there is a monochromatic rectangle.
5. (Extra Credit) We know from class that

\[ \text{if there are 5 points in the unit square then there are 2 that are} \leq \frac{\sqrt{2}}{2} \]

\[ \text{apart.} \]

Let \( d_5 = \frac{\sqrt{2}}{2} \) apart.

- Find a number \( d_6 < d_5 \) such that
  \[ \text{if there are 6 points in the unit square then there are 2 that are} \leq d_6 \]
  \[ \text{apart.} \]

- Find a number \( d_7 < d_6 \) such that
  \[ \text{if there are 7 points in the unit square then there are 2 that are} \leq d_7 \]
  \[ \text{apart.} \]

- Find a number \( d_8 < d_7 \) such that
  \[ \text{if there are 8 points in the unit square then there are 2 that are} \leq d_8 \]
  \[ \text{apart.} \]