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 $\text{ZZZ}$ and PROVE the following.

For any 3-coloring of the $4 \times \text{ZZZ}$ grid there is a monochromatic rectangle.
5. (Extra Credit) We know from class that

if there are 5 points in the unit square then there are 2 that are $\leq \frac{\sqrt{2}}{2}$ apart.

Let $d_5 = \frac{\sqrt{2}}{2}$ apart.

- Find a number $d_6 < d_5$ such that
  if there are 6 points in the unit square then there are 2 that are $\leq d_6$ apart.
- Find a number $d_7 < d_6$ such that
  if there are 7 points in the unit square then there are 2 that are $\leq d_7$ apart.
- Find a number $d_8 < d_7$ such that
  if there are 8 points in the unit square then there are 2 that are $\leq d_8$ apart.