Homework 10 MORALLY Due Apr 25 at 9:00AM
WARNING: THIS HW IS FIVE PAGES LONG!!!!!!!!!!!!!!!!!

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.

GOTO NEXT PAGE

3. (35 points) Fill in $YYY(n)$ and PROVE the following USING the technique of partitioning the square by superimposing a 4×4 grid on it, and getting lots of points in that region, and then superimposing a 4×4 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).

GOTO NEXT PAGE

4. (30 points) Fill in ZZZ and PROVE the following.

   For any 3-coloring of the $4 \times ZZZ$ *grid there is a monochromatic rectangle.*

GOTO NEXT PAGE

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.*