Homework 4, Morally Due Tue Mar 3, 2020

COURSE WEBSITE: `http://www.cs.umd.edu/~gasarch/COURSES/858/S20/index.html`

1. (0 points) What is your name? When is the midterm? By what day must you tell Dr. Gasarch you can't make the midterm? (While this problem is 0 points, if you miss the midterm and do not tell Dr. Gasarch, you will get -100 on every single homework problem 1). When is the final?

2. (40 points) Recall the second proof of the infinite can Ramsey theorem that used 3-ary, 4-color Ramsey and a maximal set argument. Finitize it. Give a bound on $\mathrm{CR}_2(k)$, where you can have a Big-Oh in the exponent.

   (Note: You will learn how to do this in the Thurs Feb 27 lecture)

3. (40 points) The $n \times m$ grid is the set of points

$$\{(a,b) : 1 \leq a \leq n \text{ and } 1 \leq b \leq m\}.$$

   In this problem we will be coloring these points.

   A *monochromatic rectangle* is when there are FOUR points that are the corners of a rectangle that are all the same color. Example would be

$$\{(3,4),(3,8),(7,4),(7,8)\}.$$

   For which values of m can the $4 \times m$ grid be 3-colored without having a monochromatic rectangle? Prove your result.

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4. (20 points) Complete the following statement of a theorem so that it is correct and then prove it:

   For all COL: $\binom{\mathbb{N}}{3} \to \omega$*, there exists an infinite set* H *such that either: BLAH, or BLAH, or ..., or BLAH.*

5. (0 points but you must do this so we can discuss) Here is a book review of a book on the Banach-Tarski Paradox:

   `http://www.cs.umd.edu/~gasarch/BLOGPAPERS/pea.pdf`

   Read the review. Be prepared to discuss if you think the BT paradox is TRUE or FALSE or SOMETHING ELSE. There is no right answer here but I want to know what you think.

6. (0 points) Compare and contrast the following parodies of Billy Joel's *The Longest Time*:

   - "The Longest Path" `https://www.youtube.com/watch?v=a3ww0gwEszo`
   - "Entropic Time" `https://www.youtube.com/watch?v=i6rVHr6OwjI` (does the singer look like anybody you know?)
   - "Graduate on Time" `https://www.youtube.com/watch?v=Vw6h6epNS5k`
   - "Polynomial Time" `https://www.youtube.com/watch?v=oO9nFOo8q_c`

   For reference, here is the original: `https://www.youtube.com/watch?v=a_XgQhMPeEQ`