

Honors Homework 1

Morally Due Mon Feb 7 at 3:30PM. Dead Cat Feb 10 at 3:30

COURSE WEBSITE:

<http://www.cs.umd.edu/~gasarch/COURSES/752/S22/index.html>

(The symbol before gasarch is a tilde.)

1. (0 points) What is your name? Write it clearly.
2. (40 points)
 - (a) (10 points) You go to a room with 3 people A_1, A_2, A_3 . 1 is normal and 2 are truth tellers. Ask YES-NO questions to them to try to determine who is who. Try to make the number of questions as small as possible. (Questions are sequential: Ask a question to A_1 , and based on the answer decide who to ask what.)
 - (b) (10 points) You go to a room with 4 people A_1, A_2, A_3, A_4 . 1 is normal and 3 are truth tellers. Ask YES-NO questions to them to try to determine who is who. Try to make the number of questions as small as possible. (Questions are sequential: Ask a question to A_1 , and based on the answer decide who to ask what.)
 - (c) (20 points) You go to a room with n people A_1, \dots, A_n . 1 is normal and $n - 1$ are truth tellers. Ask YES-NO questions to them to try to determine who is who. Try to make the number of questions as small as possible. (Questions are sequential: Ask a question to A_1 , and based on the answer decide who to ask what.)

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3. (30 points) For this problem we use the following definitions of \wedge , \vee , \neg and are using them on variables with values in $[0, 1]$.

- $x \wedge y = xy$ (Multiplication)
- $x \vee y = x + y - xy$
- $\neg x = 1 - x$.

Let

$$\phi(x, y, z) = (x \wedge \neg y) \vee z$$

Describe the set of all (x, y, z) such that $\phi(x, y, z)$ evaluates to $\geq \frac{1}{2}$.

4. (30 points) For this problem we use the following definitions of \wedge , \vee , \neg and are using them on variables with values in $[0, 1]$.

- $x \wedge y = \min\{x, y\}$
- $x \vee y = \max\{x, y\}$
- $\neg x = 1 - x$.

Let

$$\phi(x, y, z) = (x \wedge \neg y) \vee z$$

Describe the set of all (x, y, z) such that $\phi(x, y, z)$ evaluates to $\geq \frac{1}{2}$.