

Homework 7, Due MON July 28, 2014

NOTE- THIS HW IS TWO PAGES LONG.

1. (0 points) What is your name? Write it clearly. STAPLE your HW.
2. IF YOU GOT ≤ 81 on the midterm then hand in your midterm along with the problems you got wrong, only this time done right. (This will not be added to your score but will be used for consideration at the end of the semester.)
3. (25 points) Find the inverse of 101 mod 1001 using the method given in class. Show all work.

I'll begin it for you:

$$1001 = 101 \times 9 + 92$$

$$101 = 1 \times 92 + 9$$

$$9 = 4 \times 2 + 1$$

NOW we need to write 1 in terms of 1001 and 101.

$$1 = 9 - 2 \times 4$$

THE REST IS UP TO YOU.

4. (25 points)
 - (a) Find a trick for the problem of determining if a number is divisible by 11. Do you think it is really a trick?
 - (b) Find a trick for the problem of determining if a number is divisible by 13. Do you think it is really a trick?
5. (25 points) Give a Discrete Log algorithm that may take LOTS of pre-processing but once that is done it takes roughly $p^{1/10}$ steps. Describe it CLEARLY so that Liz knows what you are talking about.

6. (25 points) There are 1000 people sitting in a room in chairs in a row. They are labeled $1, 2, \dots, 1000$.

Person 1 can see the heads of people $2, 3, \dots, 1000$

Person 2 can see the heads of people $3, \dots, 1000$

etc.

Alice is going to put hats on all 1000 people. The hats are RED and BLUE.

The people may plan a strategy ahead of time. But once the hats are on they MUST do the following:

Person 1 says RED or BLUE

Person 2 says RED or BLUE

Etc.

They want to MAXIMIZE how many people say their own Hat Color.

- (a) Give them a strategy so that at least 500 get the correct hat color.
- (b) Give them a strategy so that MORE than 500 get the correct hat color. Try to have as many as possible get the correct hat color.
- (c) What if there are 3 colors of hats instead of 2? How about c colors of hats?