Ma2201/CS2022 **Discrete Mathematics** D Term, 2012
Quiz 0001

Print Name: _____
Sign: _____

1. (**2pts**) The statement "*Lightning never strikes twice in the same place*" is an example of which of the following:

a) Circular Reasoning
b) The Multiplicative Principle
c) Independence
d) Dependence

. . . . . .

The requirement imposes a condition on each strike following the first, so the location of subsequent strikes are dependent on the earlier strikes. Dependence.

2. (**5 pts**) The rules for choosing a PIN for the website `www.sendmespam.com` state that the PIN must be a is a string of 6 digits, the first digit of which must be 1 or 9, the digits in even positions must themselves be even, and the 6'th digit is a zero if no other digit is zero, and 6 otherwise.

Can a hacker be confident that he can discover your PIN in one hour by trying 1 PIN per second? Show your reasoning.

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So how many pins are there? There are two choices for the first digit.

Each of the next four digits can be independently chosen, with 5 choices for even position, and 10 choices for odd position.

The sixth digit in forced by the other five, so regardless of whether there is a zero or not in the first five, there is just a single choice for the sixth.

$$2 \cdot 5 \cdot 10 \cdot 5 \cdot 10 \cdot 1 = 5,000 > 3,600$$

the number of seconds in an hour, so the hacker trying all the possibilities has a good chance, but he cannot be confident.

3. (**3 pts**) How many ten digit numbers have at least one even digit? You may express your answer as an algebraic expression.

. . . . . .

If we start selecting, there are 10 choices for each of the digits to select *except the last* at which point we are sunk because the choices for the last digit depend on whether we have selected a zero or not.

What *don't we want*? We don't want the 5^{10} 10-digit numbers with only an even number of digits. (multiplicative principle.) So those must be subtracted from the 10^{10} 10-digit numbers without any restriction, (multiplicative principle again.)

So $10^{10} - 5^{10} = 5^{10}(2^{10} - 1)$.

[Note: The chance of getting such a number is $\dfrac{5^5(2^{10}-1)}{5^{10} \cdot 2^{10}} = \dfrac{2^{10}-1}{2^{10}}$ which is the same as your chance of flipping 10 coins and NOT getting all heads.]