CS 173, Spring 2016
Examlet 12, Part A

NETID:

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Discussion: Monday 9 10 11 12 1 2 3 4 5

(a) (9 points) Suppose that G is a graph with 30 nodes. Use proof by contradiction to show that two of the nodes have the same degree.

(b) (6 points) Suppose a car dealer is planning to buy a set of Civics, Accords, and Fits (three kinds of cars). The dealer will buy ten cars in total and can buy any number of each type. How many different choices does he have? The sets are unordered, so three Civics and seven Fits is the same as seven Fits and three Civics.

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(a) (9 points) Ignatius Eggbert flips a coin 12 times. The coin is fair, i.e. equal chance of getting a head vs. a tail. What is the chance that he gets 11 or more heads? Give an exact formula; don't try to figure out the decimal equivalent. Briefly explain your answer and/or show work.

(b) (6 points) State the negation of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

For every cat c, if c is not fierce or c wears a collar, then c is a pet.

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(a) (9 points) Use proof by contradiction to show that $\sqrt{6} - \sqrt{2} > 1$

(b) (6 points) Suppose that A is a set containing p elements and B is a set containing n elements. How many functions are there from A to $\mathbb{P}(B)$? How many of these functions are one-to-one?

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(a) (9 points) CMU's new robotic hummingbird Merrill travels in 3D. Each command makes it move one foot in a specified cardinal direction e.g. up/down, north/south, or east/west, but not diagonally. How many different sequences of 30 commands will get Merrill from position $(1, 10, 3)$ to position $(10, 6, 20)$? Briefly explain your answer and/or show work.

(b) (6 points) State the negation of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

There is a mushroom f such that f is not poisonous or f is blue.

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(a) (9 points) Ignatius Eggbert flips a coin 10 times. The coin is fair, i.e. equal chance of getting a head vs. a tail. What is the chance that he gets exactly 7 heads? Give an exact formula; don't try to figure out the decimal equivalent. Briefly explain your answer and/or show work.

(b) (6 points) State the negation of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

There is a jedi j such that j wields a red light saber and j is not fighting for the Dark Side.

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(a) (9 points) Donald Knuth has proposed a replacement for conventional resistor codes. In the new system, each resistor has 10 stripes. Each stripe can be either red, blue, or green. The type of resistor is determined by the total amount of each color. E.g. two resistors with 4 red, 5 blue, and 1 green are the same, regardless of the order in which those stripes appear. How many different types of resistor can this code represent?

(b) (6 points) State the negation of the following claim, moving all negations (e.g. "not") so that they are on individual predicates.

> There is a bug b, such that for every plant p, if b pollinates p and p is showy, then p is poisonous.