CS 173, Spring 18 Examlet 12, Part A

Name: _____

NetID: _____ **Lecture:** A B

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

(8 points) The Emerald City bakery allows customers to special-order fruit pies. Each pie can contain one fruit or a mixture of 2 or 3 (distinct) fruits. The available fruits are raspberry, blueberry, pear, apple, cherry, apricot, and peach. How many choices do you have?

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

There is a dorm room d, such that d has green walls and d has no window.

(2 points) Check the (single) box that best characterizes each item.

The number of ways to select an ordered sequence of 17 flowers chosen from 4 possible varieties.

$\binom{16}{3}$ ☐	$\binom{16}{4}$ ☐	$\binom{20}{3}$ ☐
$\binom{20}{4}$ ☐	$\binom{21}{3}$ ☐	4^{17} ☐

Name:_____

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Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

(9 points) Use proof by contradiction to show that there are no positive integer solutions to the equation $4x^2 - y^2 = 1$.

(6 points) In the game Tic-tac-toe is played on a 3x3 grid and a move consists of the first player putting an X into one of the squares, or the second player putting an O into one of the squares. The board cannot be rotated, e.g. an X in the upper right corner is different from an X in the lower left corner. How many different board configurations are possible after four moves (i.e. two moves by each player)?

Name:_____

NetID:_____ **Lecture: A B**

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(8 points) Anna has to climb 6 stairs to get onto the podium. She can climb a single step or two steps at a time. E.g. one possible (ordered) sequence of actions is: one step, a double step, three single steps. How many ways could she climb the stairs?

(5 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.

(2 points) Check the (single) box that best characterizes each item.

The number of ways to select a set of 17 flowers chosen from 4 possible varieties (zero or more of each variety).	$\binom{17}{5}$ ☐	$\binom{20}{4}$ ☐	$\binom{20}{3}$ ☐
	$\binom{17}{4}$ ☐	$\binom{21}{4}$ ☐	$\frac{17!}{4!}$ ☐

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(8 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.

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

For every Meerkat m, if m is in New York, then m is not in the wild or m is lost.

(2 points) Check the (single) box that best characterizes each item.

The number of bit strings of length 20 with exactly 7 1's.

$\binom{26}{7}$ ☐	$\binom{27}{7}$ ☐	$\binom{26}{6}$ ☐
$\binom{20}{13}$ ☐	$\binom{20}{14}$ ☐	2^{20} ☐

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(9 points) Use proof by contradiction to show that $\sqrt{2} + \sqrt{3} \leq 4$.

(6 points) Use the binomial theorem to find a closed form for the summation $\sum_{k=0}^{n} (-1)^k \binom{n}{k}$. Make sure it's clear how you used the theorem.

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(8 points) If w is a string of characters, a *substring* of w is a contiguous string that forms part of w. For example, "rtho" is a substring of "warthog" but "ahog" is not. Suppose that w is a string without any repeated characters, of length k. How many non-empty substrings does it have?

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

There is a soup s such that s is tasty and s does not contain meat.

(2 points) Check the (single) box that best characterizes each item.

How many ways can I choose 6 bagels from among 8 varieties, if I can have any number of bagels from any type?	$\frac{8!}{6!2!}$ ☐	$\frac{13!}{6!7!}$ ☐	$\frac{14!}{9!5!}$ ☐
	$\frac{14!}{6!7!}$ ☐	8^6 ☐	6^8 ☐