

Math 2001 - Assignment 6

Due October 10, 2025

- (1) How many standard Colorado license plates (3 numbers followed by 3 letters) have at least one number or letter repeated?
- (2)
 - (a) How many different 5-card hands form a Full House? Pick 5 cards from a standard 52-card deck such that 3 are of a kind (same value) and the remaining 2 are of a kind.
 - (b) How many different 5-card hands contain 4-of-a-kind (same value)?
 - (c) Is Full House of 4-of-a-kind stronger in Poker?
- (3) The street map of Manhattan is a grid with avenues running North-South and streets East-West. How many different ways are there from the corner of 1st Ave and A Street to the corner of 5th Ave and D Street if you only ever go South and West (never North or East).
Hint: Draw the grid. How many blocks do you need to go? How many West, how many South?
- (4) In a freshman class of 300 students 145 take English, 155 take Calculus and 120 Discrete Math. 90 take English and Calculus, 80 English and Discrete Math, 75 Calculus and Discrete Math, 60 take all three.
How many students take none of these three classes?
- (5) How many positive integers less or equal 100 are not multiples of 2 or 3 or 5?
- (6) How many permutations of $\{1, 2, 3, 4, 5\}$ have 1 in the first position? How many permutations do not have 1 in first or 2 in second position?
- (7) Use the Binomial Theorem to show for all $n \in \mathbb{N}$:
 - (a) $\sum_{k=0}^n \binom{n}{k} = 2^n$
 - (b) $\binom{n}{0} - \binom{n}{1} + \binom{n}{2} - \binom{n}{3} + \cdots + (-1)^n \binom{n}{n} = 0$

Hint: Which values do you want to assign for x and y in the Binomial Theorem to obtain the expressions above?