CSC 225: Fall 2022: Lab 1

1 Permutations and Combinations

1.1 Poker Hands

If you have played poker, you probably know some or all the hands below [1]. You can choose 5 cards from 52 in $\binom{52}{5}$ ways. But how many of them would be a *Royal Flush* or a *Four-of-a-Kind*? Let's try to calculate the numbers for all the following hands.

1. **Flush:** All five cards are of the same suit but not all sequential in rank.
2. **Straight:** All five cards are sequential in rank but are not all of the same suit.
3. **Three-of-a-Kind:** Three cards are all of the same rank and the other two are each of different ranks from the first three and each other.
4. **Two Pair:** Two pairs of two cards of the same rank (the ranks of each pair are different in rank, obviously, to avoid a Four-of-a-Kind)
5. **One Pair:** Only two cards of the five are of the same rank with the other three cards all having different ranks from each other and from that of the pair.

1.2 Some other problems

1. Six friends want to play enough games of chess and every one wants to play everyone else. How many games will they have to play?
2. There are five flavours of ice cream: banana, chocolate, lemon, strawberry and vanilla. We can have three scoops. How many variations will there be?
3. Determine all the integer solutions to the equation $x_1 + x_2 + x_3 + x_4 = 32$, where $x_i \geq 0$ for all $i = 1,2,3,4$.