4 STUDENTS
A B C D
DIVIDE INTO 2
TEAMS OF 2.
UNDEFINED: DO 2 TEAMS
HAVE NAMES?

AB, CD
AC, BD
AD, BC
BC AD
BD, AC
CD, AB

6

4 CHOICES FOR 1ST PLAYER.
3 FOR 2nd
PICKS EACH TEAM TWICE.

Q: does the order of the players in each team matter?
Is the 1st player the captain?
If doesn't matter: 6 possibilities.
If it does: 4x3x2=24

2

2c

how many 5-card hands?
1st card: 52
2nd: 51
...
5 cards: 52x51x50x49x48 = 52!/47!
but this ignored that I don't care about the order
how many ways could I have picked each hand? 5! ways
hands: 52!/47!/5!

easy example: 6 card deck. pick a hand of 3 cards.
card names: a b c d e f
6 choices for 1st card
then 5 choices for 2nd
then 4 for the 3rd card. gives 6x5x4 = 6!/3! =120
6! = 6x5x4x3x2x1
3! = 3x2x1
6!/3! = 6x5x4

.

But the above called these 2 hands different: abc and bca.
If I don't care about the order I picked the cards in my card,
then I have to divide by the number of ways I could have
picked each hand. That's 6.

These hands are the same: abc acb bac bca cab cba 6

That's 120/6 = 20 hands.
abc abd abe abf acd ace acf ade adf aef
bcd bce bcf bde bdf bef
cde cdf cef
def
That's 20.

If the order does matter. To pick k cards from a deck of n.
hands is n(n-1)(n-2)....(n-k+1) = n!/(n-k)!

This assumes that the cards are all different.

If order does not matter, divide that by k!
Answer is n!/(n-k)!/k! = n choose k = $\binom{n}{k}$

2e How many ways to pick 5 widgets? $\binom{100}{5}$

How many ways to pick 5 good widgets? $\binom{90}{5}$

Probability of all 5 widgets good: $\dfrac{\binom{90}{5}}{\binom{100}{5}}$

$$\frac{90!}{85!\,5!}\cdot\frac{95!\,5!}{100!} =$$

6/c

sample w replacement order matters
urn has 3 colors: r g b
pick 5 balls w replacement.
rrrrr ggggg rrrrg rrgrr rgrbr .....
3 colors for 1st x 3 colors for 2nd x 3 colors for 3rd...
3x3x3x3x3 = 3^5 = 243.

Permutations: select k from n. Order matters: n!/(n-k)!

18 Pick 4 teams of 10 players from 40 players. How many teams?

pick 1st team: 40x39x38...x31/10! = 40!/30!/10!
2nd team: 30x29...x21/10! = 30!/20!/10!
3rd team: 20!/10!/10!
4th team: 1

result: 40! 30! 20! / (30! 20! 10! 10! 10! 10!) agrees
order within each team does not matter
here, order between teams does.
sometimes it does not.