

8.4 Combinations

Note Title

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A standard deck of playing cards has:

52 cards

4 suits



13 ranks

2's, 3's, Q's, ...

How many possible 5 card poker hands are there?

$${}_{52}C_5 = \frac{52!}{47!5!}$$

"52 choose 5"

$${}_nC_r = \frac{n!}{r!(n-r)!}$$

also divide by the ones we do want

How many ways of getting:

a) A royal flush?

AKQJ10

(all the same suit)

$${}_4C_1 = \frac{4!}{1!(4-1)!}$$

$$= \frac{4!}{3!} = \frac{4 \times \cancel{3!}}{\cancel{3!}} = 4$$

$$\text{Probability: } \frac{4}{{}_{52}C_5} = \frac{4}{2598960} \approx \frac{4}{2.6 \text{ million}}$$

b) Straight flush?

5 consecutive of the same suit

9 possible high cards

Highest card:

K, Q, J, ... 5

$${}_9C_1 \times {}_4C_1 = 36$$

↑
ranks

↑
suit

$$\text{Prob: } \frac{36}{2.6 \text{ million}}$$

c) Four of a kind: KKKKA

$${}_{13}C_1 \times {}_4C_4 \times {}_{48}C_1 = 13 \times 1 \times 48 = 624$$

↑
rank of
the 4 cards

↑
all 4
cards
of that
rank

↑
the other
card

$$\text{Prob: } \frac{624}{2.6 \text{ million}}$$

Whats the probability of winning
lotto 6-49?

$$\frac{1}{49C_6} = \frac{1}{13,983,816}$$

$$\approx \frac{1}{14 \text{ million}}$$