Counting

1)
$$\underbrace{5!}_{\text{one }\cup} + \underbrace{\frac{5!}{2!}\binom{4}{3}}_{\text{two }\cup\text{'s}} + \underbrace{\frac{5!}{3!}\binom{4}{2}}_{\text{three }\cup\text{'s}} = 480$$

2)
$$\binom{13}{2}\binom{4}{2}\binom{4}{2}\binom{11}{1}\binom{4}{1} = 123552$$

two values (pairs) → $\binom{13}{2}$

suit of first → $\binom{4}{2}$

suit of second → $\binom{4}{2}$

kicker value → $\binom{11}{1}$

kicker suit → $\binom{4}{1}$

3)
$$\binom{16+6-1}{6-1} + \binom{15+6-1}{6-1} = 35853$$

16 songs
6 couples

15 songs
6 couples

4)
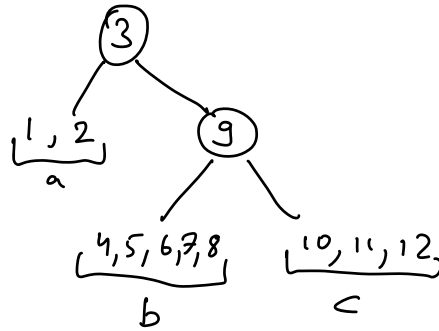
a: 2 ways

b: $\dfrac{\binom{10}{5}}{6} = 42$ ways

$2 \times 42 \times 5 = 420$
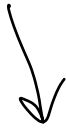
c: $\dfrac{\binom{6}{3}}{4} = 5$ ways

5)

at least 3 vaccined

$$\binom{9}{2} + \binom{9}{3} = 120$$

7 friends   6 friends

3 nurses   4 nurses