

### problem 6

A bridge hand is just a committee of 13 cards.

A "good" bridge hand is a hand with at least one card whose face value is higher than 9 (higher than 9 means 10, J, Q, K or A)

Find the prob that a good bridge hand contains at least one card lower than 6.

WARNING You have to interpret the question correctly, i.e., what probability are you trying to find.

### solution 6

We want a *conditional probability*:

$$P(\text{at least one card lower than 6 in a bridge hand} | \text{good bridge hand})$$

$$= P(\text{at least one card} < 6 | \text{at least one card} > 9)$$

$$= \frac{P(\text{at least one} < 6 \text{ and at least one} > 9)}{P(\text{at least one} > 9)}$$

$$\text{Denominator} = 1 - P(\text{all} \leq 9) = 1 - \frac{\binom{32}{13}}{\binom{52}{13}}$$

$$\text{Numerator} = 1 - P(\text{all cards} \geq 6 \text{ OR } \text{all} \leq 9)$$

$$= 1 - \left[ P(\text{all} \geq 6) + P(\text{all} \leq 9) - P(6 \leq \text{all} \leq 9) \right]$$

$$= 1 - \frac{\binom{36}{13} + \binom{32}{13} - \binom{16}{13}}{\binom{52}{13}}$$