

# 605 Discussion Wk 6

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## Chapter 4. Conditional Probability

15. (a) What is the probability that your bridge partner has exactly two aces, given that she has at least one ace?

$$P(F|E) = \frac{P(F \cap E)}{P(E)}$$

There are 52 different cards in a deck and each bridge hand has 13 cards. First we find the probability of having two aces given having at least one ace:

```
Top.A <- (comb(48,11)*comb(4,2)/comb(52,13))
```

$$P(F \cap E) = \frac{\binom{48}{11} \binom{4}{2}}{\binom{52}{13}}$$

Then we find the probability of having at least once ace:

```
Bottom.A <- (comb(52,13)-comb(48,13))/comb(52,13)
```

$$P(E) = \frac{\binom{52}{13} - \binom{48}{13}}{\binom{52}{13}}$$

Therefore:

```
Top.A/Bottom.A
```

```
## [1] 0.306663
```

$$P(F|E) = \frac{P(F \cap E)}{P(E)} = \frac{\binom{48}{11} \binom{4}{2}}{\binom{52}{13} - \binom{48}{13}} = 0.307$$

(b) What is the probability that your bridge partner has exactly two aces, given that she has the ace of spades?

$$P(F|E) = \frac{P(F \cap E)}{P(E)}$$

Just as before, we start knowing that there are 52 different cards in a deck and each bridge hand has 13 cards. We need to find first the probability:

```
Top.B <- (comb(48, 11)*comb(3, 1))/comb(52,13)
```

$$P(F \cap E) = \frac{\binom{48}{11} \binom{3}{1}}{\binom{52}{13}}$$

To find the the probability of having the ace of spades:

```
Bottom.B <- comb(51,12)/comb(52,13)
```

$$P(E) = \frac{\binom{51}{12}}{\binom{52}{13}}$$

Therefore:

```
Top.B/Bottom.B
```

```
## [1] 0.4269868
```

$$P(F|E) = \frac{P(F \cap E)}{P(E)} = \frac{\binom{48}{11} \binom{3}{1}}{\binom{51}{12}} = 0.427$$