

## 1 Lesson 1 Example 4

In standard poker, each player is dealt 5 cards off the top of a (shuffled) deck of cards. The hand is called a “flush” if all 5 cards are the same suit. What is the probability that you get a flush of hearts (i.e., all 5 cards are hearts)?

## 2 Answer

Consider the probabilities of drawing each successive heart to calculate the probability of being dealt a flush of hearts.

### 1. First Card:

The probability that the first card is a heart is:

$$P(\text{first card is a heart}) = \frac{13}{52}$$

### 2. Second Card:

Given that the first card was a heart, the probability that the second card is also a heart is:

$$P(\text{second card is a heart} \mid \text{first card is a heart}) = \frac{12}{51}$$

### 3. Third Card:

Given that the first two cards were hearts, the probability that the third card is also a heart is:

$$P(\text{third card is a heart} \mid \text{first two cards are hearts}) = \frac{11}{50}$$

### 4. Fourth Card:

Given that the first three cards were hearts, the probability that the fourth card is also a heart is:

$$P(\text{fourth card is a heart} \mid \text{first three cards are hearts}) = \frac{10}{49}$$

### 5. Fifth Card:

Given that the first four cards were hearts, the probability that the fifth card is also a heart is:

$$P(\text{fifth card is a heart} \mid \text{first four cards are hearts}) = \frac{9}{48}$$

To find the total probability of all five cards being hearts, multiply these individual probabilities together:

$$P(\text{flush of hearts}) = \frac{13}{52} \times \frac{12}{51} \times \frac{11}{50} \times \frac{10}{49} \times \frac{9}{48}$$

Calculating this:

$$P(\text{flush of hearts}) = \frac{13 \times 12 \times 11 \times 10 \times 9}{52 \times 51 \times 50 \times 49 \times 48}$$

$$P(\text{flush of hearts}) \approx \frac{154440}{311875200} \approx 0.000495$$

Therefore, the probability of being dealt a flush of hearts in a standard poker game is approximately 0.000495 or 0.0495%.