

## CISC 1100 - HW 8

### SOLUTIONS

A standard deck has 52 cards, 2 through 10, and 4 face cards, J, Q, K, A.

1) Suppose you are drawing a standard 5 card hand. Write your answers as fractions. Find the probability of the following:

The denominator for everything is  ${}_{52}C_5 = 2,598,960$

a) Getting 4 aces.

$${}_4C_4 \cdot {}_{48}C_1 = 48$$

Pick all 4 aces; pick one card of the remaining 48.

The probability is  $48/2,598,960 = 1/54,145$ .

b) Getting exactly 2 kings.

$${}_4C_2 \cdot {}_{48}C_3 = 6 \cdot 17296 = 103,776$$

From the 4 kings pick 2; from the 48 non-Kings pick 3.

The probability is  $103,776/2,598,960 = 2,162/54,145$ .

c) Getting a full house.

$${}_{13}C_1 \cdot {}_4C_3 \cdot {}_{12}C_1 \cdot {}_4C_2 = 13 \cdot 4 \cdot 12 \cdot 6 = 3,744$$

From the 13 denominations pick 1; from that denomination (4 cards) pick 3; from the remaining 12 denominations pick 1; from that denomination (4 cards) pick 2.

The probability is  $3744/2,598,960 = 6/4,165$ .

d) Getting at least 3 eights.

This is getting three eights or getting four eights.

$$\text{Three eights: } {}_4C_3 \cdot {}_{48}C_2 = 4 \cdot 1128 = 4,512$$

Four eights: same as aces, (a), so 240.

Adding up, we have 4,752.

The probability is  $4752/2,598,960 = 99/54,145$ .

e) Getting a flush (5 consecutive cards of the same suit, e.g. 9, 10, J, Q, K).

The easiest way to count this is to count the number of flushes, then consider the ways to be dealt them.

The "largest" flush is 10, J, Q, K, A. If we consider A, 2, ..., 5 to be a flush, there are 10 flushes (starting with A, with 2, ..., with 10). Otherwise (starting at 2) there are 9.

There are 4 suits, so there are 40 or 36 flushes, depending on if we count A, 2, ....

The probability is  $40/2,598,960 = 1/64,974$  or  $36/2,598,960 = 3/216,580$ .

I explained this wrong in class so it's free points.

2) a) Suppose that, in a medical test, 346 people were tested. 315 were sick, however only 20 people had a false test result when they were healthy. If the probability that a test came back positive given that the patient was sick is  $43/63$ , fill out a full probability tree (use patient is sick as the first event and test came back positive for the second event).

Ask for picture

b) What is the probability of a false positive?

$$P(E' \cap F) =$$

c) What is the probability of a false negative?

$$P(E \cap F') =$$