Stefan Eng
William Watkins
Chapter: 2 Math 340
Problems: 29, 37, 55, 59, 71, 74 9/9/13

Introduction to Probability
Homework 2

Problem 29

a) The experiment is randomly selecting two jurors from a group of two women and four men. A sample point is selecting one of the men and one of the women.

b) Given that we have $W_1, W_2, M_1, M_2, M_3, M_4$ the sample space is:
$E_1 = \{W_1, W_2\}$, $E_6 = \{W_2, M_1\}$, $E_{10} = \{M_1, M_2\}$, $E_{13} = \{M_2, M_3\}$, $E_{15} = \{M_3, M_4\}$.
$E_2 = \{W_1, M_1\}$, $E_7 = \{W_2, M_2\}$, $E_{11} = \{M_1, M_3\}$, $E_{14} = \{M_2, M_4\}$,
$E_3 = \{W_1, M_2\}$, $E_8 = \{W_2, M_3\}$, $E_{12} = \{M_1, M_4\}$,
$E_4 = \{W_1, M_3\}$, $E_9 = \{W_2, M_4\}$,
$E_5 = \{W_1, M_4\}$,

c) The probability that both of the jurors are women is: $P(E_1) = 1/15$

Problem 37

a) Since order does matter, the business women can travel in $6 * 5 * 4 * 3 * 2 = 720$ ways.

b) The woman either travels to Denver first or San Francisco first. Since we only have two outcomes the probability is .5.

Problem 55

a) Since the order the nurses getting picked does not matter, we can use combinations:

$$\binom{90}{10} = \frac{90!}{10!\ 80!} = 2.07 \times 10^{18}$$

b) To get the number of times that 4 male nurses and 6 female nurses are seen in the sample points, we first need to choose 4 male nurses out of 20. Then choose 6 female nurses out of the remaining 70 nurses. The total number of combinations of nurses is given by:

$$P(A) = \frac{n_a}{N} = \frac{\binom{20}{4}\binom{70}{6}}{\binom{90}{10}}$$

Problem 59

a) There are $\binom{52}{5}$ sample points. Since there are 4 of each kind of card in the deck there is 4^5 ways to draw the straight we want. Therefore the probability of drawing the straight we want is:

$$P(A) = \frac{n_a}{N} = \frac{1024}{\binom{52}{5}} = 3.94 \times 10^{-4}$$

b) Using the result of part a, with the knowledge that there are 10 other ways to rearrange the straight, we get:

$$P(A) = 3.94 \times 10^{-3}$$

Problem 71

Given that, $P(A) = .5, P(B) = .3P(A \cap B) = .1$

a) $P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{.1}{.3} = \frac{1}{3}$

b) $P(B|A) = \frac{P(B \cap A)}{P(A)} = \frac{.1}{.5} = \frac{1}{5}$

c)

$$\begin{aligned} P(A|A \cup B) &= \frac{P(A \cap (A \cup B))}{P(A \cap B)} \\ &= \frac{P(A \cup (A \cap B))}{P(A) + P(B) - P(A \cap B)} \\ &= \frac{P(A) + P(A \cap B) - P(A \cap (A \cap B))}{P(A) + P(B) - P(A \cap B)} \\ &= \frac{.5}{.5 + .3 - .1} \\ &= \frac{5}{7} \end{aligned}$$

d) $P(A|A \cap B) = \frac{P(A \cap (A \cap B)}{P(A \cap B} = 1$

e)

$$\begin{aligned} P(A \cap B | A \cup B) &= \frac{P((A \cap B) \cap (A \cup B))}{.7} \\ &= \frac{P(A \cap B)}{.7} \\ &= \frac{1}{7} \end{aligned}$$

Problem 74

To figure out which events are independent we must first divide each Yes/No row by its percent of the total. This will allow us to compare the Yes and No rows.

a) **A and D**: Since $\frac{.20}{.30} \neq \frac{.41}{.70}$ we see that it does matter if we selected a parent with a child in college so these events are **dependent**.

b) **B and D**: Since $\frac{.09}{.30} = \frac{.21}{.70}$ we can see that a child in college does not influence the *About Right* group. Therefore, B and D are **independent**.

c) **C and D**: Since $\frac{.01}{.30} \neq \frac{.08}{.70}$ we see (from the same argument as a) that C and D are **dependent**.