Casino Lab Solutions

STATION 1. CRAPS

c. Probability Questions

1. $P(7 \text{ or } 11) = \frac{6}{36} + \frac{2}{36} = \frac{8}{36} = \frac{2}{9}$

2. $P(2, 3, \text{ or } 12) = \frac{1}{36} + \frac{2}{36} + \frac{1}{36} = \frac{4}{36} = \frac{1}{9}$

3. $P(\text{roll again}) = 1 - \left(\frac{2}{9} + \frac{1}{9}\right) = \frac{6}{9} = \frac{2}{3}$

4. $P(\text{win}|\, 8) = \frac{5}{11}$, since the only outcomes that matter after the first roll are getting an 8 or getting a 7. There are 5 ways to get a sum of 8 and 6 ways to get a sum of 7, so the probability of getting an 8 first is 5/11.

d. The probabilities on the branches of the tree diagram should be the answer to parts (c)1, 2, and 3, respectively.

Bonus:

$P(\text{win}|P(\text{win at craps}) = P(\text{win on 1st roll}) + P(\text{win on subsequent roll})$

$= \frac{2}{9} + P(\text{win with 4}) + P(\text{win with 5}) + P(\text{win with 6}) + P(\text{win with 8}) + P(\text{win with 9}) + P(\text{win with 10})$

$= \frac{2}{9} + \frac{3}{36}\cdot\frac{3}{9} + \frac{4}{36}\cdot\frac{4}{10} + \frac{5}{36}\cdot\frac{5}{11} + \frac{5}{36}\cdot\frac{5}{11} + \frac{4}{36}\cdot\frac{4}{10} + \frac{3}{36}\cdot\frac{3}{9} = \frac{244}{495} = 0.4929$

STATION 2. ROULETTE

2. b.

x_i	-1	1
p_i	$\frac{20}{38}$	$\frac{18}{38}$

c. $\mu_X = \sum x_i p_i = -1\cdot\frac{20}{38} + 1\cdot\frac{18}{38} = \frac{18}{38} = -0.053$

d. $\sigma_X^2 = \sum\left(x_i - \mu_X\right)^2 \cdot p_i = (-1-(-0.053...))^2 \cdot \frac{20}{38} + (1- \ (-0.053...))^2 \cdot \frac{18}{38} = 0.9972$

$\sigma_X = \sqrt{\sigma_X^2} = \sqrt{0.9972} = 0.9986$

e. $\mu_{X_1+X_2} = \mu_{X_1} + \mu_{X_2} = -0.053 + (-0.053) = -.106$

$\sigma_{X_1+X_2}^2 = \sigma_{X_1}^2 + \sigma_{X_2}^2 = 0.9972 + 0.9972 = 1.9944$ (since the random variables are independent)

$\sigma_X = \sqrt{\sigma_X^2} = \sqrt{1.9944} = 1.412$

STATION 3. BLACKJACK

2. a. P("blackjack"| face-up card is ace) = $\frac{2}{51}$

   b. P("twenty-one" | face-up card is ace) = $\frac{16}{51}$

3. a. P("blackjack" | face-up card is black Jack) = $\frac{4}{51}$

   b. P("twenty-one" | face-up card is black Jack) = $\frac{4}{51}$

4. P("blackjack") = $\frac{4}{52}\cdot\frac{2}{51}+\frac{2}{52}\cdot\frac{4}{51}=\frac{4}{663}\approx 0.006$

5. a. Are the events independent? NO. P(you get "blackjack" | face-up card is black Jack) = $\frac{4}{51}$, but P(you get blackjack) = $\frac{4}{663}$.

   b. Are the events disjoint? NO. Both can happen at the same time.

STATION 4. COINS, DICE, CARDS, AND TREES

1. P(odd number of heads and sum of 10 on dice after tossing) = $\frac{1}{2}\cdot\frac{3}{36}=\frac{1}{24}$

2. P(even number of heads and 10 drawn from deck after tossing) = $\frac{1}{2}\cdot\frac{4}{52}=\frac{1}{26}$

3. P(2 heads and 2 tails | 10 on second stage of game) = $\dfrac{({}_4C_2)(0.5)^4\cdot\frac{4}{52}}{\frac{1}{24}+\frac{1}{26}}=0.36$

STATION 5. MONTE'S DILEMMA

2. 1/3

3. Disagree. You are better off in the long run if you switch doors after one is shown.

4. The possibilities for the woman are GB, BG, and BB. For the man, the possibilities are BB and BG if we consider the order in which the children were born.