Harsh Singh - hw3 - hsingh23

5.2. King Lear decides to allocate three provinces (1, 2, and 3) to his daughters (Goneril, Regan and Cordelia - read the book) at random. Each gets one province. What is the space of outcomes?

Let Goneril, Regan and Cordelia be g,r,c respectively the 3!/0! = 6 outcomes are

g1 r2 c3, g1 r3 c2,
g2 r1 c3, g2 r3 c1,
g3 r2 c1, g3 r1 c2

5.6. You roll a fair four sided die, and then a fair six sided die. You add the numbers on the two dice. What is the probability the result is even?

Fact: odd+odd = even, even+even=even
P(odd_4,6) = ½ , P(even_4,6) = ½
P(odd_4+odd_6) + P(even_4+even_6) = ¼ + ¼ = ½

5.9. At a particular University, 1/2 of the students drink alcohol and 1/3 of the students smoke cigarettes.
(a) What is the largest possible fraction of students who do neither?
(b) It turns out that, in fact, 1/3 of the students do neither. What fraction of the students does both?

a) ½
b) ½ + ⅔ - x = 1
x = ⅙

5.10. I flip two coins. What one set needs to be added to this collection of sets to form an event space?
Σ = {∅, Ω,{T H},{HT, T H, T T },{HH},{HT, T T },{HH, T H}}
{HH, HT, TT}

5.14. You remove the king of hearts from a standard deck of cards, then shuffle it and draw a card.
(a) What is the probability this card is a king?
3/51
(b) What is the probability this card is a heart?
12/51

5.18. You shuffle a standard deck of cards, then draw seven cards. What is the probability that you see no aces?
(48 C 7) / (52 C 7) = 48/52 * 47/51 * 46/50 * 45/49 * 44/48 * 43/47 * 42/46 ~= 55.04%

5.19. Show that P(A − (B ∪ C)) = P(A) − P(A ∩ B) − P(A ∩ C) + P(A ∩ B ∩ C).
Probability is like size; P(A − (B ∪ C)) is the size of A - the size of B in A - the size of C in A; The size of B in A is P(A ∩ B); the size of C in A is P(A ∩ C) but these pieces may overlap and we have just subtracted the overlapping pieces twice. So we must add the the overlapping piece back P(A ∩ B ∩ C).

5.20. You draw a single card from a standard 52 card deck. What is the probability that it is red?
½

5.21. You remove all heart cards from a standard 52 card deck, then draw a single card from the result. What is the probability that the card you draw is red?
13/39

5.23. You take a standard deck of cards, shuffle it, and remove one card. You then draw a card.
(a) What is the conditional probability that the card you draw is a red king, conditioned on the removed card being a king?
1**/52 * 49/52 = 1/49**

(b) What is the conditional probability that the card you draw is a red king, conditioned on the removed card being a red king?
(1/52) / (51/52) = 1/51

(c) What is the conditional probability that the card you draw is a red king, conditioned on the removed card being a black ace?
(2/52) / (51/52) = 2/51

5.26. You take a standard deck of cards, shuffle it, and remove both red kings. You then draw a card.
(a) Is the event {card is red} independent of the event {card is a queen}?
P(card is red) = 24/50
P(card is queen) = 4/50
2/50 /= 24/50 * 4/50 So they are not independent.

(b) Is the event {card is black} independent of the event {card is a king}?
P(card is black) = 26/50
P(card is king) = 2/50
2/50 /= 26/50 * 2/50 So they are not independent.

Rule 3: if the car is at 1, then choose 2; if at 2, choose 3; if at 3, choose 1.
Rule 4: choose from the doors with goats behind them uniformly and at random.

5.27. Monty Hall, Rule 3: If the host uses rule 3, then what is P(C1|G2, r3)? Do this by computing conditional probabilities.
P(C1|G2, r3) = P(C1 ∩ G2)/P(G2)1 = ⅓ / ⅓ = 1

5.28. Monty Hall, Rule 4: If the host uses rule 4, and shows you a goat behind door 2, what is P(C1|G2, r4)? Do this by computing conditional probabilities.
P(C1|G2, r4) = P(C1 ∩ G2)/P(G2)1/2