**Computing Probabilities by Counting Outcomes**

**3.9** Assume each outcome in omh has the same probability. In this case, show

P(E)=Number of outcomes in E/Total number of outcomes omh

Solution: Sample space = outcome1+outcome2……+outcomeN

Let e be the event which occurs for every outcome1,outcome2 …..outcomeN.

P(e1) = e1/outcome1, P(e2) = e2/outcome2 …. P(eN) = eN/outcomeN

P(E ) = number of outcomes in E/total outcomes in sample space

P(E) = count(P(e1),P(e2)…P(eN)/sample space

Hence P(E) = (Number of outcomes in E)/(Total number of outcomes)

**3.10** 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?

Solution: Sample Space = 4\*6 = 24

P(Even on 4 sided) = 2/4= ½

P(Even on 6 sided) = 3/6 = ½

P(Even) = ½\*1/2 + ½\*1/2 = ½

**3.11** You roll a fair 20 sided die. What is the probability of getting an even number?

Solution: Sample Space = 20

P(Even) = 10/20 = 1/2

**3.12** You roll a fair five sided die. What is the probability of getting an even number?

Solution: Sample Space = 5

P(Even) = 2/5

**3.13** *I am indebted to Amin Sadeghi for this exercise.* You must sort four balls into two buckets. There are two white, one red and one green ball.

**(a)** For each ball, you choose a bucket independently and at random, with probability 1/2 . Show that the probability each bucket has a colored ball in it is ½.

Solution: Sample Space 2W,1R,1G = 4 balls

P(Red) =1/4

P(Green) =¼

P (Bucket has colored balls) = 1 – P (Bucket has no colored balls)

= 1 – P(W)/sample space

= 1 – 2/4

= 1/2

**The Probability of Events**

**3.14** You flip a fair coin three times. What is the probability of seeing HTH? (i.e., Heads, then Tails, then Heads)

Solution: -Sample space = 2^3 = 8

P(HTH) = 1/8 = 0.125 (same order)

P(HTH) = 3/8 = 0.375(without order)

**3.15** You shuffle a standard deck of playing cards and draw a card.

**(a)**What is the probability that this is a king?

Solution: Sample Space= 52

P(King) = 4/52 = 1/13=7.69

**(b)** What is the probability that this is a heart?

Solution: Sample Space = 52

P(Heart) = 13/52 = ¼ = 0.25

(c) What is the probability that this is a red card (i.e., a heart or a diamond)?

Solution: Sample Space = 52

P (Red(Heart or Diamond)) = (13 + 13)/52 = 26/52 = ½ = 0.5

3.16 A roulette wheel has 36 slots numbered 1–36. Of these slots, the odd numbers are red and the even numbers are black. There are two slots numbered zero, which are green. The croupier spins the wheel, and throws a ball onto the surface; the ball bounces around and ends up in a slot (which is chosen fairly and at random).

**(a)** What is the probability the ball ends up in a green slot?

Solution:

**(b)** What is the probability the ball ends up in a red slot with an even number?

Solution:

**(c)** What is the probability the ball ends up in a red slot with a number divisible by 7?

Solution:

**3.17** You flip a fair coin three times. What is the probability of seeing two heads and one tail?

Solution: Sample Space = 2^3 = 8

P(2H1T) = 3/8= 0.375

**3.18** 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?

Solution: Sample Space = 51

P(King) = 3/51=0.058

**(b)**. What is the probability this card is a heart?

Solution: Sample Space = 51

P(Heart) = 12/51 = 0.235

**3.19** You shuffle a standard deck of cards, then draw four cards.

Solution: Sample space = 52

P(4 cards) = 4/52 = 0.076