Math 17C
Kouba
Discussion Sheet 9

1.) Consider a basket containing 5 yellow and 7 black kittens. Close your eyes, reach in, and pick two kittens without replacement. What is the probability that

a.) the 1st kitten is black ?
b.) the 2nd kitten is black given that the 1st kitten is yellow ?
c.) the 2nd kitten is yellow ?
d.) the 2nd kitten is yellow given that the 1st kitten is yellow ?
e.) the 2nd kitten is black ?

2.) Consider a standard 52-card deck of playing cards. A face card is any Jack, Queen, or King. Pick three cards without replacement from the deck. What is the probability that

a.) the 1st card is a face card ?
b.) the 2nd card is a face card given that the first card is a face card ?
c.) the 2nd card is a not face card ?
d.) the 3rd card is not a face card given that the first card is a face card ?
e.) the 3rd card is a face card ?
f.) the 3rd card is not a face card given that the 2nd card is not a face card ?

3.) A bag contains 1 blue, 2 white, and 3 red balls. Select 3 balls without replacement. What is the probability that the

a.) the 1st ball is red ?
b.) the 2nd ball is red given that the 1st ball is white ?
c.) the second ball is red ?
d.) the third ball is white given that the second ball is blue ?
e.) the 3rd ball is red ?
f.) the 3rd ball is blue ?

4.) Randomly select 2 cards one at a time from a standard deck of playing cards. Let A be the event that the 1st card is a 3 or 4. Let B be the event that the 2nd card is a Jack, Queen, or King. Determine if A and B are independent events.

a.) Assume that the two cards are selected one at a time WITHOUT replacement.
b.) Assume that the two cards are selected one at a time WITH replacement.

5.) Assume that the probability a newborn is a boy is exactly 1/2 and the probability it's a girl is exactly 1/2. If gender outcomes from child to child are independent, what is the probability that a family of 7 children will consist

a.) of all girls ?
b.) of 4 boys and 3 girls ?
c.) of 5 girls and 2 boys ?
d.) at least 1 girl ?
e.) at most 5 boys ?

6.) LeBron James of the Miami Heat shoots field goals at the rate of 0.510. Assuming that his shots are independent events, what is the probability that he will

a.) make 5 shots in a row ?

b.) miss 4 shots in a row ?

c.) make exactly 5 out of 6 shots ?

d.) make exactly 12 out of 21 shots ?

e.) make at least 1 out of 10 shots ?

7.) In an NBA playoff game against the Oklahoma City Thunder power forward Dirk Nowitzki of the Dallas Mavericks made 24 out of 24 free throws ! Dirk shoots free throws at the rate of 0.892. Assuming that his shots are independent events, what is the probability that he will

a.) make 24 out of 24 shots ?

b.) miss 4 shots in a row ?

c.) make exactly 4 out of 6 shots ?

d.) make at most 8 out of 10 shots ?

8.) You have 15 decks of standard playing cards. Randomly select 1 card from each deck. What is the probability that there will be at least 1 matching pair (same suit and same face value) ?

9.) A blood test for the HIV virus shows a positive (+) result in 98% of all cases when the virus is actually present in an individual and in 6% of all cases when the virus is NOT present in an individual (false positive). Assume that 1 out of every 250 people are carriers of the virus.

a.) What is the probability that a person tests positive for the HIV virus ?

b.) What is the probability that a person tests negative for the HIV virus ?

c.) What is the probability that a person is a carrier given that the person tests positive ?

d.) What is the probability that a person is a non-carrier given that the person tests positive ?

e.) What is the probability that a person tests positive given that the person is a carrier of the HIV virus ? Assuming that these tests are independent events, what is the probability that a carrier tests positive twice ? three times ?

f.) What is the probability that a person tests positive given that the person is a non-carrier of the HIV virus ? Assuming that these tests are independent events, what is the probability that a non-carrier tests positive twice ? three times ?

g.) (challenging) What is the probability that a random person tests positive twice ? three times ?

h.) (challenging) What is the probability that a person is a carrier given that the person tests positive twice ? three times ?

i.) (challenging) What is the probability that a person is a non-carrier given that the person tests negative twice ? three times ?

10.) (Genetics– Mendel's First Law) Gregor Mendel (Austria 1856) studied pea plants and the color of their flowers determined by two genes in their chromosomes. Assume that the following genotypes are possible : CC, Cc (same as cC), and cc, where types CC and Cc produce red flowers and type cc produces white flowers. Suppose that you have a batch of red- and white-flowering pea plants, where all three genotypes CC, Cc, and cc are represented. Assume that 15% of the plants are type CC, 30% of the plants are type Cc, and 55% of the plants are type cc. You will pick 1 parent plant at random from the batch and cross it with a pea plant of genotype cc.

a.) What is the probability that the offspring will have red flowers ? white flowers ?

b.) What is the probability that the batch parent plant was of genotype Cc given that offspring had red flowers ?

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"Gravitation is not responsible for people falling in love." – Albert Einstein