This homework will not be collected, but this material will appear on the midterm.

1. Recall that Huntington’s Chorea is a serious degenerative disease of the nervous system that is caused by the presence of a single dominant allele \( D \). People who have the \( D \) allele usually begin to show symptoms between the ages of 40 and 50. Joseph has just been diagnosed with Huntington’s. Since his mother did not have the disease, this means that Joseph’s genotype is \( Dd \). The genotype of Joseph’s wife Delilah is unknown, but her mother lived to be 96 years old without developing HC. So, we can assume Delilah’s mother was genotype \( dd \).

(a) If Delilah is genotype \( dd \), what is the probability that their child would inherit the \( D \) allele (and therefore develop Huntington’s Chorea)?

(b) If Delilah is genotype \( dd \) and the couple has five children, what is the probability that exactly three of them will inherit the \( D \) allele?

(c) If Delilah is genotype \( Dd \), what is the probability that their child would inherit the \( D \) allele?

(d) If Delilah is genotype \( Dd \) and the couple has five children, what is the probability that at least one of them will inherit the \( D \) allele?

2. Suppose you draw a card from a standard deck 5 times, replacing each card before you draw the next.

(a) What is the probability of drawing the ace of hearts exactly three times?

(b) What is the probability of drawing at least four Queens?

(c) What is the probability of drawing at least one club?

3. An experiment consists of rolling a fair die and then picking a marble from one of two bowls. If you roll a 1, then you will draw from Bowl 1, which contains 3 red marbles, 2 blue marbles, and 6 green marbles. If you roll anything other than a 1, then you will draw from Bowl 2, which contains 4 red marbles and 1 green marble.

(a) What is the probability that you draw a red marble, given that you roll a 3?

(b) What is the probability that you draw a green marble?

(c) What is the probability that you rolled a 1, given that you drew a green marble?

(d) If you repeat this experiment (rolling the die and picking the marble) twenty times, what is the probability that you draw a green marble exactly ten times?

4. Suppose you draw a card from a standard deck 15 times, replacing the card each time.

(a) What is the probability that you draw exactly 8 kings?

(b) What is the probability that you draw at least 14 face cards?

(c) What is the probability that you draw at least one spade?
ANSWERS:

1. a) 0.5; b) 0.3125; c) 0.75; d) 0.9990

2. a) 0.000068411; b) 0.0001643; c) 0.7627

3. a) 0.8; b) 0.2576; c) 0.3529; d) 0.01209

4. a) 0.000004505; b) 0.000000014; c) 0.9866