**Homework**
**Biostatistics (STAT:3510; Bognar)**

1. Suppose a 6-sided die (with sides labeled 1, 2, 3, 4, 5, 6) is rolled 2 times.

   (a) Let $A$ denote the event that a 1 is obtained on the first roll, and let $B$ denote the event that an even is obtained on the second roll. Find the probability that events $A$ and $B$ both occur. In other words, find $P(A \cap B)$.

   (b) Let $A$ denote the event that a 1 is obtained on the first roll, and let $B$ denote the event that an even is obtained on the second roll. Find the probability that $A$ occurs, $B$ occurs, or both $A$ and $B$ occur. In other words, find $P(A \cup B)$.

2. Suppose you randomly select 2 chips *with* replacement from a bowl containing 3 red ($R$) and 5 white ($W$) chips. Let $R_1$ denote the event that a red chip is obtained on the first draw, let $R_2$ denote the event that a red chip is obtained on the second draw. Find $P(R_1 \cap R_2)$.

3. Based on long-run relative frequencies, approximately 51% of all births in the U.S. are boys (i.e. $P(B) = 0.51$, $P(G) = 0.49$). Assume independence.

   (a) If a woman has 3 children, find the probability that she has all boys.

   (b) If a woman has 3 children, find the probability that she does not have all boys. *Use complement rule.*

   (c) If a woman has 3 children, find the probability that the first child is a boy, while the last 2 children are girls.

   (d) If a woman has 3 children, find the probability that she has exactly 1 boy. *Hint:* $P\left[(B_1 \cap G_2 \cap G_3) \cup (...) \cup (...)\right]$.

   (e) If a woman has 3 children, find the probability that she has 1 or more boys. *Use the complement rule.*

4. Suppose that 4% of desktop computers in a large hospital run the Linux operating system ($L$).

   (a) Suppose 2 computers are randomly selected (*assume independence*). Find the probability that neither computer is running Linux, i.e. find $P(L_1^c \cap L_2^c)$.

   (b) Suppose 2 computers are randomly selected (*assume independence*). Find the probability that the first computer runs Linux ($L_1$), the second computer runs linux ($L_2$), or both run Linux. In other words, find $P(L_1 \cup L_2)$.

   (c) Suppose 2 computers are randomly selected (*assume independence*). Find the probability that exactly one of the computers runs Linux. *Hint:* $P\left[(L_1 \cap L_2^c) \cup (...)\right]$.

   (d) Suppose computers are repeatedly selected (assume independence). Find the probability that the 4th selected computer is the first one running Linux. In other words, find $P(L_1^c \cap L_2^c \cap L_3^c \cap L_4)$.

   (e) Suppose 5 computers are randomly selected (*assume independence*). Find the probability that 1 or more run linux. *Use the complement rule.*

5. Suppose a die is repeatedly rolled. Find the probability that a 1 is obtained for the first time on the 10th roll. *Hint: To get a 1 for the first time on the 10th roll, you must get a non-one on the 1st roll ($1_1^c$), a non-one on the second roll ($1_2^c$),..., a non-one on the 9th roll ($1_9^c$), and a one on the 10th roll ($1_{10}$).*