Psychology 310
Homework Problem Set 4

Note: We strongly suggest you use R functions like **`pnorm`**, **`dbinom`**, **`choose`**, **`factorial`**, and **`pbinom`** to answer these questions.

1. Suppose $\Omega = \{1,2,3,4,5,6\}$, $A = \{1,3,4\}$, and $B = \{3,5,6\}$.
Find:

a. $A - B$
b. $B - A$
c. $A \cap B$
d. $\overline{A}$
e. $\overline{A \cup B}$
f. $\overline{A} \cap \overline{B}$
g. $A \cup B$
h. $\overline{A \cap B}$
i. $\overline{A} \cup \overline{B}$
j. $(A \cup B) - (A \cap B)$

2. Suppose I draw 5 cards at random from a poker deck. What is the probability that I draw a two-pair hand where both pairs are red (i.e., consist of a heart and a diamond of the same value)?

3. I have a pegboard with 100 holes. How many distinctly different ways can I arrange 100 pegs in these holes, when 60 of the pegs are red and 40 are white?

4. The country of Slopakia has 5 states, each of which has 2 senators. Each state has 100 citizens who are the appropriate age to serve in the senate. Slopakia has a unique political system in which senators are allowed to serve only one term, and senators are chosen completely at random (without replacement) from the population of eligible citizens in that state. How many different senates can be chosen?

5. You live in Grenonia, the first state in Slopakia. You are the appropriate age to serve in the senate. What is the probability that you will be selected for the senate?

6. In a specific area, Candidate O is favored by 52% of the population, while the rest favor candidate P. What is the probability that if 200 people are phoned at random, and they answer truthfully, at least 52% of them will favor candidate O?

7. In the long run, an unfair coin comes up heads with probability .5850. What is the probability that, if you flip this coin 8 times, you will obtain *at least 5 heads*?

8. Suppose that, in each of two large precincts, exactly 52% of the voters favor candidate A over candidate B. If you randomly survey 200 voters in each precinct, what is the probability that the polls will be within 3 percentage points of each other. (*Hint:* For a quick solution, use the normal approximation to the binomial. Call the first proportion p_1, the second p_2. Now consider their difference $p_1 - p_2$. What will its approximate distribution be?)

9. Suppose the probability that a child will be a boy is .5124. Marilyn decides to keep having children until she has 2 boys, at which point she will stop having children. What is the probability that she will have exactly 4 children?

10. The probability that you pass the course (PC), *given that you pass the first exam* (PE1), is .90. The probability that you pass the first exam is also .90. What is the probability that you pass the first exam *and* pass the course, i.e., $\Pr(PC \cap PE1)$?

11. The probability that you are a Glog is .70. The probability that you are a Zorg is .70. The probability that you are a Glog or a Zorg or both is .80. What is the probability that you are a Glog and a Zorg?

12. What is the probability of throwing 7 independent fair dice and having them all come up ones?