# Exam 1 Review

**Chapter 2**

1. How would you define probability, in words?

2. What is a sample space, and what notation do we use for it?

3. What does $A \subset B$ mean, in words? Draw a picture of this relationship.

4. What does $A \cup B$ mean, in words? Draw a picture of this relationship.

5. What does $A \cap B$ mean, in words? Draw a picture of this relationship.

6. What does $A'$ mean, in words? Draw a picture of this event.

7. What notation do we use for the *null* or *empty* set?

8. What does **mutually exclusive** mean, in words? If $A$ and $B$ are mutually exclusive, what do we know about $A \cap B$? What about $A \cup B$?

9. What does **mutually exhaustive** mean, in words? If $A, B, C$ are mutually exhuastive, what do we know about $P(A \cup B \cup C)$?

10. What is another way to re-write $A \cap (B \cup C)$?

11. What is another way to re-write $A \cup (B \cap C)$?

12. What is another way to re-write $(A \cup B)'$?

13. What is another way to re-write $(A \cap B)'$?

14. Probabilities always have to fall between what two values?

15. If $A_1, A_2, A_3, ...A_k$ are disjoint events, how can you re-write $P(A_1 \cup A_2 \cup ... \cup A_k)$?

16. What is another way to re-write $1 - P(A')$?

17. What is $P(\emptyset)$?

18. TRUE/FALSE, If $A \subset B$, then $P(A) \leq P(B)$

19. If given $P(A \cup B)$, $P(A)$, and $P(B)$, how do you find $P(A \cap B)$?

20. If procedure 1 has $n_1$ possible outcomes, and procedure 2 has $n_2$ possible outcomes, how many possible outcomes does the composite procedure have?

21. What does $n!$ mean?

22. What is the formula for the total number of ways to ORDER $r$ unique subjects selected from $n$ subjects (without replacement)? Is this a permutation or a combination?

23. What is the formula for the total number of ways to order $r$ unique subjects selected WITH replacement from $n$ subjects?

24. What is the formula for the total number of ways to CHOOSE $r$ unique subjects selected from $n$ subjects (without replacement)? Is this a permutation or a combination?

25. What is the formula for $\binom{n}{r}$? How do you read $\binom{n}{r}$, in words?

26. What is the formula for splitting $n$ distinct objects into $k$ distinct groups of size $n_1, n_2, \ldots n_k$?

27. What's the formula for $P(B|A)$? What is this called?

28. If $A$ and $B$ are independent, what is $P(A|B)$? $P(B|A)$? $P(A \cap B)$?

29. How can you re-write $P(A \cap B)$ in terms of a conditional probability?

30. How do you check if two events $A$ and $B$ are independent?

31. If A and B are independent, what do you know about A and B', A' and B, and A' and B'?

32. Set up a tree diagram where the first experiment has two possible outcomes $A$ and $A'$, and the second experiment has two possible outcomes $B$ and $B'$. Label the each of the following on the appropriate branches or indicate if the probability is not represented by a branch:

    - $P(A)$
    - $P(A')$
    - $P(A|B)$
    - $P(A'|B)$
    - $P(B|A)$
    - $P(B|A')$
    - $P(B'|A)$
    - $P(B'|A')$

33. Describe how you would use the tree diagram above to find:

    - $P(A \cap B)$
    - $P(A' \cap B')$
    - $P(B)$
    - $P(A|B)$

34. How can you re-write $P(A)$ using the Law of Total Probability? Explain in words what this means. How does it relate to Bayes Theorem?

**Chapter 3**

1. What condition do you check to verify that a function $p(y)$ is a valid probability distribution?

2. What is $p(y)$ when $y \notin S$?

3. How do we write $p(y)$ in terms of a probability?

4. How do you find an expression for the mean of a discrete random variable? What are two ways to denote the mean?

5. How do you find $E[g(Y)]$ for a discrete random variable $Y$?

6. How can you simplify $E(aY + b)$?

7. How do you find the variance of a discrete random variable? (Shortcut formula)

1. What happens to the variance of $Y$ if a constant is added to all $y$ values? That is, what is $V(Y + c)$?

2. What happens to the variance is all $y$ values are multiplied by a constant? That is, what is $V(cY)$?

3. What is $V(aY + b)$?

4. For each of the following distributions, list the mean, variance, and probability distribution. Note what scenarios each distribution is good for modeling.
    a. Uniform (discrete)
    b. Bernoulli
    c. Binomial