Stat 2470, 1/15 Discussion Questions Name ______________________

Instructions: Attempt to answer these questions by reading the textbook or with online resources before coming to class on the date above.

1. What is an "experiment" in statistical terms?

any activity or process whose outcome is subject to uncertainty

2. What is the definition of a sample space?

the set of all possible outcomes of an experiment

3. What are all the events in a sample space of 3 coin flips? Imagine flipping one coin three times in a row and listing the possible outcomes. A tree diagram could help.

HHH, HHT, HTH, THH, TTH, THT, HTT, TTT

4. What is an "event"? What is the difference between a simple events and a compound event? Use the sample space in #3 to list the event that has three heads, and the event with two heads. Which of these is simple and which is compound?

- a subset of a sample space

a simple event is a single element of a sample space that can't be broken down any further. a compound event is any collection of simple events.

3 Heads: HHH (simple) 2 Heads: HHT, HTH, THH (compound)

5. What is the complement of an event and how is it notated in our book?

Complement of an event A is all the possible events not in A, denoted by A'

6. What is the union notation (for the union of events A and B)? What is the intersection notation (for the intersection of events A and B)?

$A \cup B$, $A \cap B$

7. Let the universe be $\{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$. What is the complement of A if A is $\{0, 1, 2, 8\}$?

$A' = \{3, 4, 5, 6, 7, 9\}$

8. If B is $\{0, 2, 3, 7, 9\}$ and A is as above, what is $A \cup B$? What is $A \cap B$?

$A \cup B = \{0, 1, 2, 3, 7, 8, 9\}$

$A \cap B = \{0, 2\}$

9. If $A = [0,1]$ and $B = [-2,1]$. What is $A \cup B$? What is $A \cap B$?

$A \cup B = [-2, 1]$

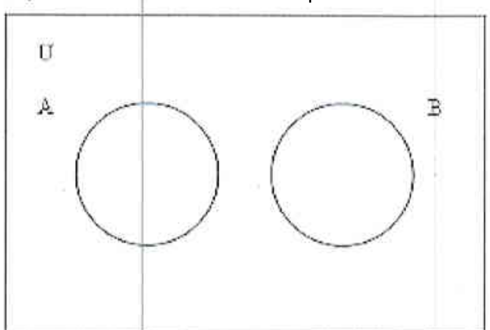
$A \cap B = [0, 1]$

10. What does it mean for two events to be mutually exclusive or disjoint? Give an example.

their intersection is zero. all complementary events are disjoint. ex. [2,3] and [5,7]

11. Label each Venn diagram below to say what concept is being illustrated. You may need to use unions, intersections and complements.

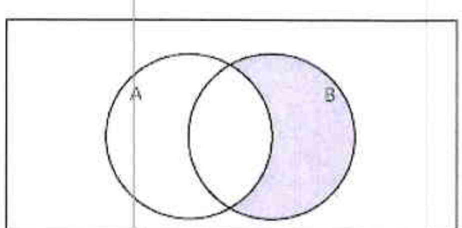
a.



disjoint events

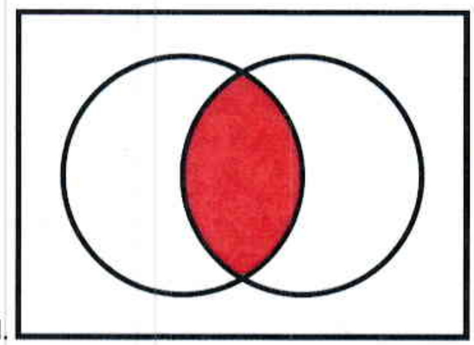
$A \cap B = \emptyset$

b.



$A' \cap B$

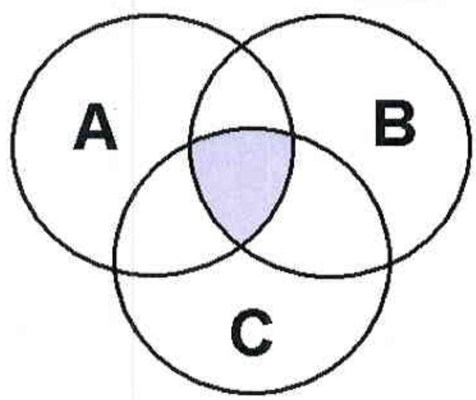
d.



intersection

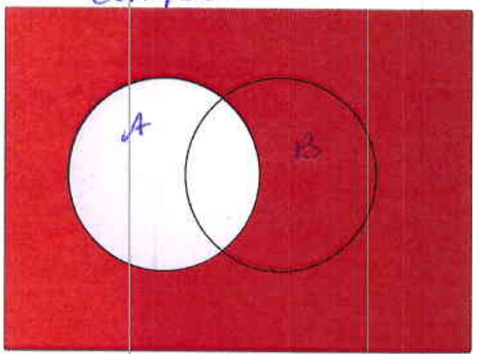
$A \cap B$

e.



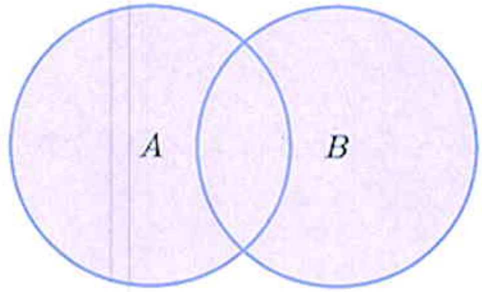
intersection $A \cap B \cap C$

A'
Complement



c.

$A \cup B$



f.

12. What is the probability of an impossible event? What is the probability of a certain event?

0 1

13. What are some ways of interpreting a probability? Why are rare events hard to interpret?

long run relative frequency; proportion of events in the sample space; proportion of outcomes in an experiment

14. What is the formula for calculating the probability of the complement of an event?

event probability $P(A)$ complement probability $1 - P(A) = P(A')$

15. What is the formula for the union of an event? Explain in your own words why we need to subtract off the intersection if the events are not disjoint?

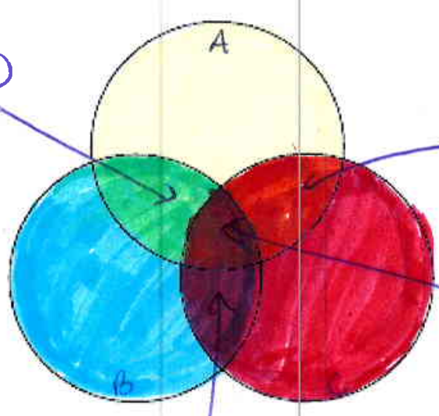
$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

to avoid double counting

16. What is the formula for the probability for the union of three events? The Venn diagram for three events is shown below. Label each piece on the formula on the diagram.

$P(A) + P(B) + P(C) - P(A \cap B) - P(A \cap C) - P(B \cap C) + P(A \cap B \cap C)$

$P(A \cap B)$



$P(A \cap C)$

$P(A \cap B \cap C)$

$P(B \cap C)$

17. Give some examples, at least three, of events that are equally likely.

Outcomes on a fair coin (H, T)
outcomes on a fair die (1, 2, 3, 4, 5, 6)
outcomes of any combination of these.

pulling cards out of a well-shuffled deck, any individual card, face or suit

18. What is a tree diagram and how can it be used for counting sample spaces?

the tree diagram for flipping 2 coins
branches of tree give outcomes
HH, HT, TH & TT

19. The general product rule (or fundamental counting principle) is used to find a general k-tuple, or the number of outcomes of k events with n_i outcomes per event. Give an example of an event that can be counted this way.

The number of sequences we can flip a fair coin/die a certain # of times, passwords, licence plates combination

20. How are permutations and combinations different? How are they different than the fundamental counting principle?

permutations do not allow repetitions but order matters AB, BA diff.
Combinations also don't allow repetition, but order does <u>not</u> matter
AB = BA same

21. What is the formula for a permutation? What is the formula for a combination? Use both versions of the notation for combinations.

$P(n,r)$ or ${}_nP_r = \frac{n!}{(n-r)!}$

or $P_{n,k}$

$C(n,r)$ or ${}_nC_r$ or $\binom{n}{r} = \frac{n!}{r!(n-r)!} = \frac{{}_nP_r}{r!}$

or $C_{n,k}$