Print Your Name: _Key-1_

T.A. or Section Number: _____

## WORK ALL OF PROBLEMS 1-4.

1. (8 points each) A survey of magazine subscribers placed 66 celebrities in three categories. 41 were on the most powerful list, 32 were on the most liked list, and 25 were on the most trustworthy list. 5 celebrities were on all three lists. 19 were on both the most powerful and most liked lists, 15 were on the most powerful and most trustworthy lists, and 9 were on the most liked and most trustworthy lists.

(a) Draw a Venn Diagram to represent this information. Label the number of celebrities in each portion of your diagram.

$$\begin{array}{r} 41 \\ +13 \\ +\ 6 \\ \hline 60 \end{array}$$
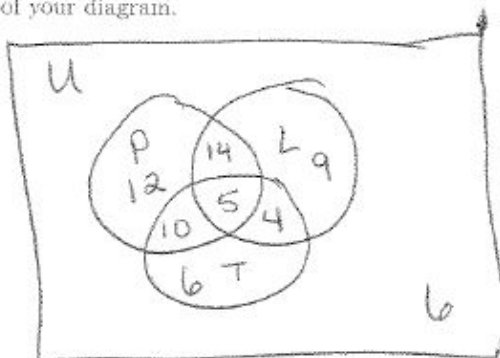


P = powerful
L = liked
T = trustworthy

(b) Determine the number of celebrities who were on exactly one of the three lists. Simplify your answer as far as possible.

Exactly one $= 12 + 9 + 6$

$= \boxed{27}$ celebrities

(c) Determine the number of celebrities who were on exactly two of the lists. Simplify your answer as far as possible.

Exactly two $= 14 + 10 + 4$

$= \boxed{28}$ celebrities

5

2. (13 points) How many poker hands contain a three-of-a-kind? Recall: a poker hand is a 5-card draw from a deck of 52 cards. You do not need to simplify your final answer.

3-of-a-kind:

$$C(13,1) \cdot C(4,3) \cdot C(12,2) \cdot C(4,1) \cdot C(4,1)$$

denom for triple

suits for triple

denoms for single cards

suits for singles

3. (13 points) A fair coin is tossed seven times. How many outcomes contain more heads than tails? Simplify your answer as far as possible.

More H than T $\iff$ at least 4 H

4H or 5H or 6H or 7H

$$= C(7,4) + C(7,5) + C(7,6) + C(7,7)$$

$$= \frac{7 \cdot 6 \cdot 5 \cdot 4}{4 \cdot 3 \cdot 2 \cdot 1} + \frac{7 \cdot 6}{2} + 7 + 1 = 35 + 21 + 8$$

$$= \boxed{64} \text{ outcomes}$$

4. (13 points) In how many ways can a committee of 8 senators be selected from the 100 members of the U.S. Senate so that no two committee members are from the same state? (Recall that each state has 2 senators.) You do not need to simplify your final answer.

Pick 8 states  and  a senator from each state

$$\binom{50}{8} \cdot \left[ \binom{2}{1} \right]^8$$

$$= \boxed{C(50,8) \cdot 2^8} \text{ ways}$$

3.

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poker hand

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WORK ONLY FOUR (4) OF THE REMAINING FIVE PROBLEMS
(NUMBERS 4-7). WRITE "OMIT" OVER THE PROBLEM YOU DO NOT
WANT GRADED. IF YOU DO NOT INDICATE WHICH PROBLEM TO
OMIT, THEN ONLY THE FIRST FOUR WILL BE GRADED.

5. (10 points) Draw a 3-circle Venn diagram and shade the portion of the diagram that represents the set $(A \cap B') \cup C'$.
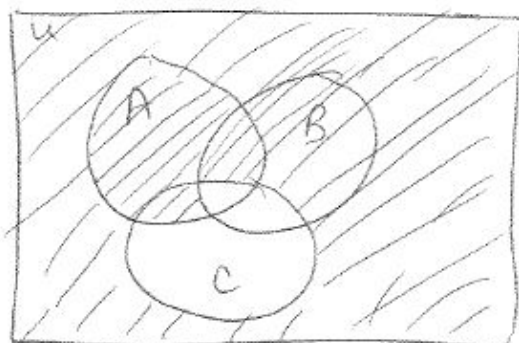


6. (10 points) Let $U = \{$univesities in the United States$\}$, $A = \{$set of universities in the United States that have the name of a city in their name$\}$, and $B = \{$set of universities in the United States that have the word North in their name$\}$. Describe in words the set $A' \cap B$.

$A' \cap B = \{$universities in the United States that have the word North but do not have the name of a city in their name$\}$

7. (10 points) Two 12-member basketball teams play a game. After the game, each of the members of the winning team shakes hands once with each member of both teams. How many handshakes take place? Simplify your answer as far as possible.

24 total people

# handshakes $= 12 \cdot 12 + 11 + 10 + 9 + 8 + 7 + 6$
$\qquad\qquad\qquad\qquad + 5 + 4 + 3 + 2 + 1$
$\qquad\qquad = 144 + 66$
$\qquad\qquad = \boxed{210}$ handshakes

8. (10 points) In a mystery game, there are five suspects in a murder that was committed in any of nine rooms, using any one of six weapons. How many scenarios are possible? Leave your answer as a product of integers.

Suspect $*$ room $*$ weapon
$\boxed{5 \cdot 9 \cdot 6}$ scenarios

9. (10 points) Six married couples go out on a movie date. They sit together on one row in the movie theater. In how many ways can they be seated so that no two men sit next to each other?

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Place the women in 6! ways
" " men in P(7,6) ways

$\Rightarrow \boxed{P(7,6) \cdot 6!}$ ways

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Print Your Name: __Key-2__

T.A. or Section Number: _____

## WORK ALL OF PROBLEMS 1-4.

1. (13 points) In how many ways can a committee of 10 senators be selected from the 100 members of the U.S. Senate so that no two committee members are from the same state? (Recall that each state has 2 senators.) You do not need to simplify your final answer.

$$\binom{50}{10} \cdot 2^{10} \text{ ways}$$

Choose 10 states

Choose a senator from each state

2. (13 points) How many poker hands contain one pair? Recall: a poker hand is a 5-card draw from a deck of 52 cards. You do not need to simplify your final answer.
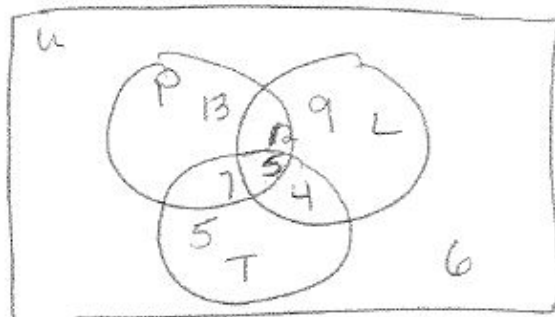
$$C(13,1) \cdot C(4,2) \cdot C(12,3) \cdot \left[ C(4,1) \right]^3$$

denom for pair

suits for pair

denoms for single cards

suits for single cards

3. (13 points) A fair coin is tossed nine times. How many outcomes contain more heads than tails? Simplify your answer as far as possible.

$$C(9,5) + C(9,6) + C(9,7) + C(9,8) + C(9,9)$$

$$= \frac{9 \cdot 8 \cdot 7 \cdot 6}{4 \cdot 3 \cdot 2 \cdot 1} + \frac{9 \cdot 8 \cdot 7}{3 \cdot 2 \cdot 1} + \frac{9 \cdot 8}{2} + 9 + 1$$

$$= 126 + 84 + 36 + 10 = \boxed{256} \text{ outcomes}$$

4. (8 points each) A survey of magazine subscribers placed 61 celebrities in three categories. 37 were on the most powerful list, 30 were on the most liked list, and 21 were on the most trustworthy list. 5 celebrities were on all three lists. 17 were on both the most powerful and most liked lists, 12 were on the most powerful and most trustworthy lists, and 9 were on the most liked and most trustworthy lists.

(a) Draw a Venn Diagram to represent this information. Label the number of celebrities in each portion of your diagram.



(b) Determine the number of celebrities who were on exactly one of the three lists. Simplify your answer as far as possible.

$$\text{exactly one} = 13 + 9 + 5$$
$$= \boxed{27}$$

(c) Determine the number of celebrities who were on exactly two of the lists. Simplify your answer as far as possible.

$$\text{exactly two} = 12 + 7 + 4$$
$$= \boxed{23}$$

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**WORK ONLY FOUR (4) OF THE REMAINING FIVE PROBLEMS (NUMBERS 4-7). WRITE "OMIT" OVER THE PROBLEM YOU DO NOT WANT GRADED. IF YOU DO NOT INDICATE WHICH PROBLEM TO OMIT, THEN ONLY THE FIRST FOUR WILL BE GRADED.**

5. (10 points) Five married couples go out on a movie date. They sit together on one row in the movie theater. In how many ways can they be seated so that no two men sit next to each other?

$$\_ W \_ W \_ W \_ W \_ W \_$$

$$5! \cdot P(6,5) \quad ways$$

6. (10 points) Draw a 3-circle Venn diagram and shade the portion of the diagram that represents the set $A' \cup (B \cap C')$.
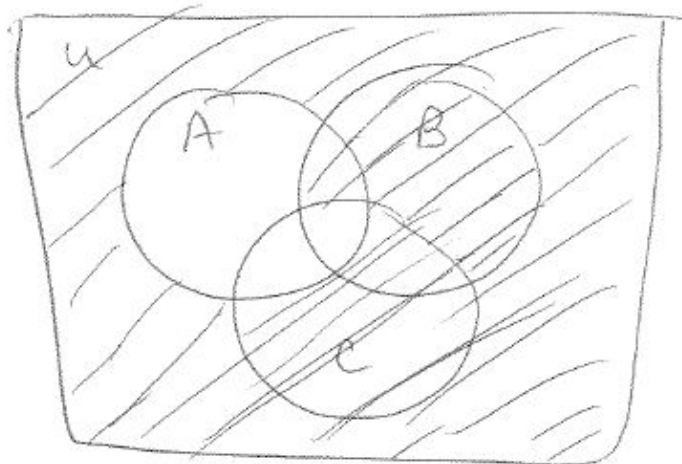
7. (10 points) Two 14-member basketball teams play a game. After the game, each of the members of the winning team shakes hands once with each member of both teams. How many handshakes take place? Simplify your answer as far as possible.

$$\text{\# of handshakes} = 14 \cdot 14 + 13 + 12 + 11 + 10 + 9 + 8 + 7 + 6 + 5 + 4 + 3 + 2 + 1$$

$$= 196 + 91$$

$$= \boxed{287} \text{ handshakes}$$

8. (10 points) Let $U$ = {univesities in the United States}, $A$ = {set of universities in the United States that have the name of a city in their name}, and $B$ = {set of universities in the United States that have the word North in their name}. Describe in words the set $A \cap B'$.

$A \cap B' = \{$universities in the US with the name of a city in their name but **not** the word "North"$\}$

9. (10 points) In a mystery game, there are six suspects in a murder that was committed in any of eight rooms, using any one of seven weapons. How many scenarios are possible? Leave your answer as a product of integers.

$\boxed{6 \cdot 8 \cdot 7}$ scenarios

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cs ates liilmt have the word North in their nanle}. Describe in words the set: