DISCRETE MATHEMATICS APPLICATIONS

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ABSTRACT:

In Spring 2021, we learn various concepts and techniques in CS208/MA208 Discrete Mathematics. For the weekly online discussions, we are to propose live, creative, or imaginary applications to utilize concepts or techniques that we learn in class. In this poster, we show some of the applications that we come up with.

Author: Uranbaigali Bayarjargal
Problem: Let X be a set of all animals, and x belongs to X.

L(x) - x live on land
W(x) - x live underwater

A lion and a cow live on land but not underwater. A turtle can live both on land and underwater. As for a goldfish, it can only live underwater. Construct a truth table and answer the following questions:

1. Is $\forall x(L(x) \rightarrow W(x))$ true? Justify your answer.
2. Is $\exists x(L(x) \wedge W(x))$ true? Justify your answer.
3. Is $\exists x(W(x) \leftrightarrow L(x))$ true? Justify your answer.

Problem:
A high school volleyball team consists of 11 players total. In a game, only 6 players are allowed to play at a time.
1. How many ways can you choose the 6 players to play a match?
2. How many of these options include player #3?

Problem:
A group of 22 students are assigned to 7 different Zoom breakout rooms. What's the smallest possible number of students at breakout rooms having the most students?

Author: Corrie Scobee
Problem:

P : The piggy went to the market
R : The piggy ate roast beef
If the little piggy went to the market but did not eat any roast beef, what would P and R evaluate to?
In other words, $P \wedge R$=? (True/False)

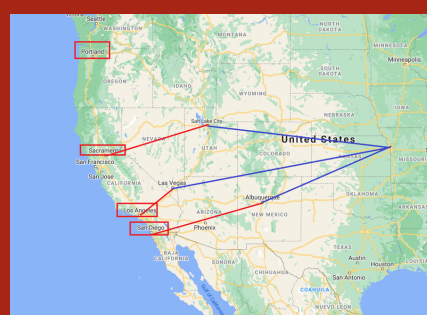**Problem:**
How many ways are there to permute the letters in DISCUSSION?

Author: Noel Cheda
Problem: Examine the map that represents the NBA teams and conferences in USA.

1. What is the set cardinality for the state of Florida?
2. True or False. Raptors $\in$ USA-NBA.
3. Are the number of elements in the West Conference and the number of elements in the East Conference the same?
4. True or False. Western Conference $\subseteq$ NBA.
5. List all the elements in the universal set for this problem.
6. What is the symbol representing the elements in Kansas?

Problem:
4 friends in different cities want to fly to Kansas City. The red lines are the first part of their flights, and the blue lines are the second flights.
1) True or False. The people flying out of California have one to one first flights.
1.5) Yes or No. Are the first flights for the Californians bijective?
2) Yes or No. For the 4 friends, can this be considered as a function?
3) True or False. The second part of the trips for the Californians is M-1.

Author: David Lamb
Problem:
Your local burger restaurant wants to streamline the process of adding orders to the system at checkout. The company is doing this by adding buttons that show the unique order possibilities on the menu. The menu is comprised of drinks, burgers, fries, and sweets. Construct a power set that shows all of the possible unique combinations that the company will need to put in the new system.

Problem:
Abby, Zack, Tyler, and Andrew all love to play sports. Abby likes to lift weights competitively. Zack likes to run. Tyler likes to lift weights competitively. Andrew loves to go swimming. None of them like to play baseball. Identify if the relationship between these four and their sports is considered a function. If it is a function, is it One-One or Many-One? Is it onto? Is it bijective?

Problem:
Your local robotics team is having problems figuring out if their proposed logic is correct for their maze robot. Their robot has to navigate a maze based on lines on the ground. When a sensor is activated (hits a line), the robot will change direction based on which sensor is activated. Below is the table for their robot's sensors.

Sensor Left	Sensor Right	Sensor Forward	Turn
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

For their robot to function, only one sensor can be active at a time. Propose a circuit that they can use for the highlighted situations above where the robot would need to turn.

Author: Danielle Adams
Problem:
G= {bravery, helping others, chivalry, student of Hogwarts}
S= {ambition, cunning, heritage, student of Hogwarts}
$G \oplus S$ = ?

Problem:
When filling cups with 12 different flavors of soda randomly, how many cups need to be filled to guarantee that at least 4 cups contain the same flavor?

Author: Ryan Allsup
Problem:
Let A be a family = {Great Grandmother, Grandpa, Mother, Son}
xRy means that x is older than y.
Reflexive: T/F
Anti-Reflexive: T/F
Symmetric: T/F
Transitive: T/F
Anti-Symmetric: T/F
Justify your answer