

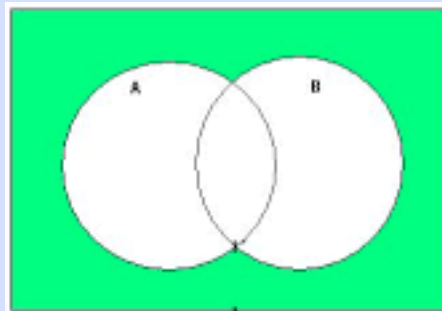
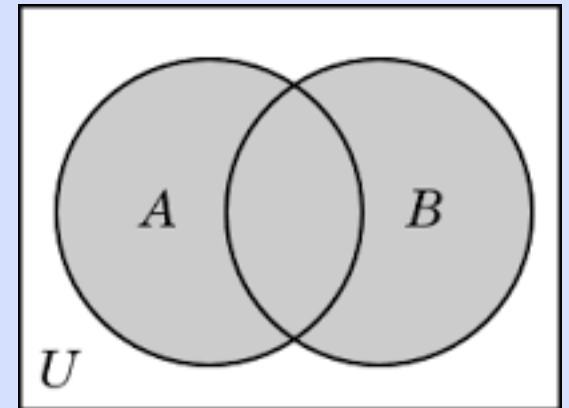
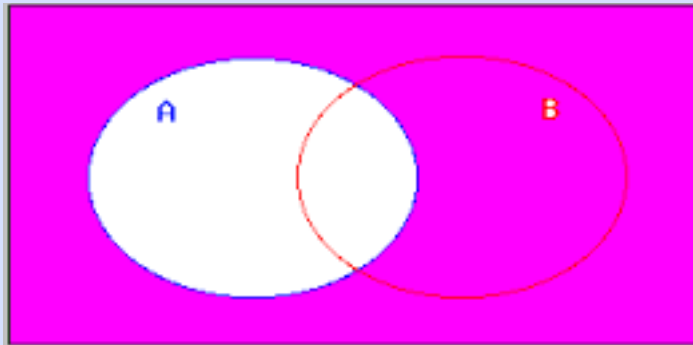
Jeopardy

CISIC 1100
hooray math

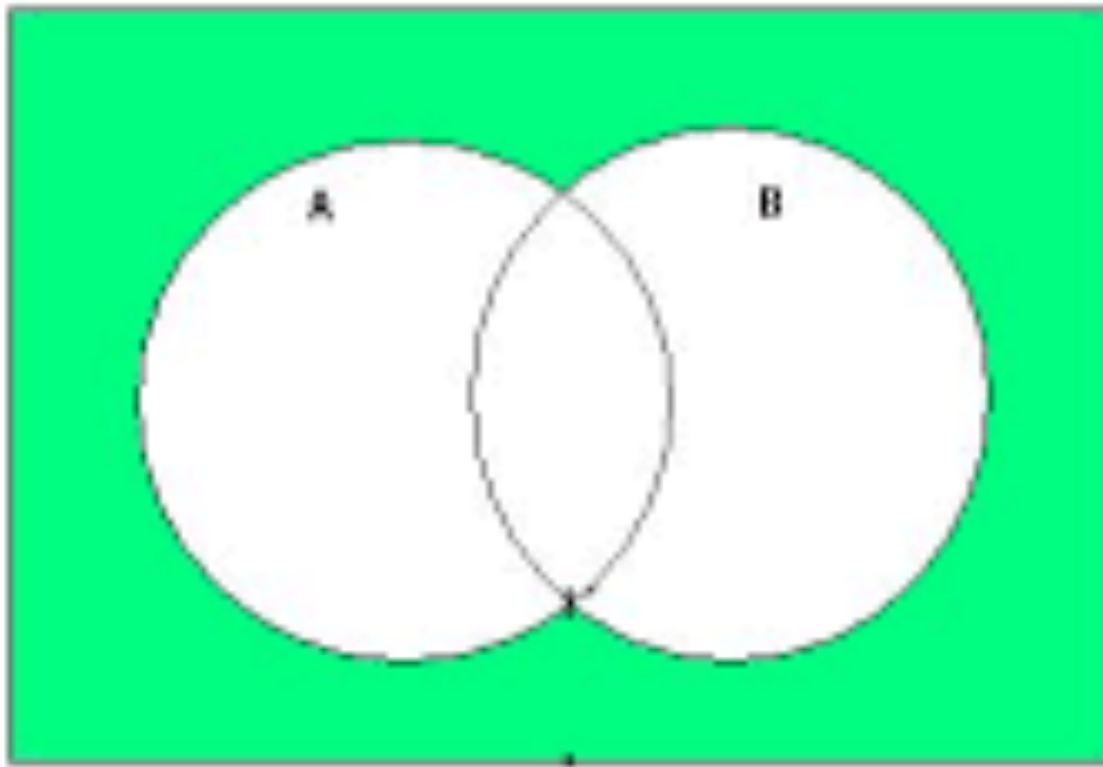
Get Set	Logically speaking	Relative terms	Mod squad	Free apps
<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>10</u>
<u>20</u>	<u>20</u>	<u>20</u>	<u>20</u>	<u>20</u>
<u>30</u>	<u>30</u>	<u>30</u>	<u>30</u>	<u>30</u>
<u>40</u>	<u>40</u>	<u>40</u>	<u>40</u>	<u>40</u>
<u>50</u>	<u>50</u>	<u>50</u>	<u>50</u>	<u>50</u>

Get Set - 10

If $A, B \subseteq U$ for some universal set U ,
which of the following is the venn diagram for $(A \cup B)'$?



Get Set – 10



Get Set - 20

If $A, B, C \subseteq U$ for some universal set U ,
which of the following is true?

a) $(A \cup B) \cap C = A \cup (B \cap C)$

b) $(A \cap B)' = A' \cap B'$

c) $A \subseteq B, B \subseteq C \Rightarrow A \subseteq C$

Get Set – 20

$$c) A \subseteq B, B \subseteq C \Rightarrow A \subseteq C$$



Get Set - 30

- If in a survey of 100 readers, 35 people read *Quoi?* and 72 people read *Don't*, how many people read both magazines if 80 people read either?

Get Set – 30

- $80 = 72 + 35 - |Q \text{ and } D|$
- So, 27



Get Set - 40

- In a recent survey, 54 people own both a toaster and a microwave, while 67 people own either. If 200 people were surveyed, what is the maximum possible number of people who own only a microwave?

Get Set – 40

- $67 = |M| + |T| - 54$
- If $|T| = 54$, $|M| = 67$
- Notice $|M|$ cannot be greater than 67, since a union of two sets is the same size or larger than either one.



Get Set - 50

- In the numbers 1-20, primes make up 40%. Numbers divisible by 2 make up 50%. How many numbers (not percent) are neither prime nor divisible by 2?

Get Set – 50

$$|P| = 8; |T| = 10; |P \cap T| = 1$$

$$|P \cup T| = 8 + 10 - 1 = 17$$

$$\therefore |P \cap T| = |U| - |P \cup T| = 20 - 17 = 3$$

^^^ should be (PUT)'
sorry



Logically Speaking- 10

If p,q are false then is the following true?

$$(p \wedge q')' \Leftrightarrow (p \Rightarrow q)$$

Logically Speaking– 10

- Yes, that statement is always true. It is actually the logic behind proof by contradiction.



Logically Speaking - 20

- What is the variable in the following predicate:
 - “What makes a man an earnest, caring and compassionate is his empathy; without it he is nothing.”

Logically Speaking – 20

- Empathy



Logically Speaking - 30

If p,q,r are false then is the following true?

$$[(p \vee q')' \Rightarrow r'] \Leftrightarrow (p \Rightarrow q) \wedge (q' \wedge r')$$

Logically Speaking – 30

- True



Logically Speaking - 40

Let $p(x) := x^2 + 1 < 4$, $q(x) := \frac{1}{x^2 - 1} > 4$

Is the following true when $-1 < x < 1$?

$$p(x) \vee q(x)' \Leftrightarrow p(x) \wedge q(x)$$

Logically Speaking – 40

- False. $p(x)$ is true and $q(x)$ is false.



Logically Speaking- 50

- Consider the following propositions:
 - A wet bird never flies at night.
 - I'll only catch the red eye to LA if it's cheaper.
 - All ticket prices drop on Wednesdays.
 - On Wednesdays we wear pink.
- True or false: If I'm not wearing pink I'm a wet bird.

Logically Speaking – 50

- Yep, I'm a wet bird.



Relative terms - 10

Is the relation $r_{\text{odd}} = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : x - y \text{ is odd}\}$ reflexive?

Relative terms – 10

- No; 0 is even, so x is not related to x .



Relative terms - 20

- My pantry has eggs, milk, sugar, flour, brown sugar, chocolate chips, butter, apples and cinnamon
- I want to make snickerdoodles, chocolate chip cookies and apple pie
- Consider the relation x “is an ingredient of” y .
- Classify this relation!

Relative terms – 20

- This is irreflexive, antisymmetric and intransitive (not transitive)
 - Unless you put cookies in your pie, which is either genius or madness



Relative terms - 30

- Let S be the set of my siblings (no twins) and let r be the relation x “is older than” y
- Does r well order S ? If so, what is the “least” element of S ?

Relative terms – 30

- Yes!
- Irreflexive: nobody is older than themselves
- Antisymmetric: if x is older than y , y is not older than x (since there are no twins)
- Transitive: Obvious
- Successor: We can always say one is older than the other
- “Least” element: Whoever is the oldest has the property $x R y$ for all y not equal to x .



Relative terms - 40

Let $A_0 = \emptyset, A_1 = \{A_0\}, A_2 = \{A_0, A_1\}, \dots, A_n = \{A_0, A_1, \dots, A_{n-1}\}$.
Let $r = \{(A_k, A_m) \in A_n \times A_n : A_k \in A_m\}$
Is r symmetric, antisymmetric or neither?

Relative terms – 40

- r is antisymmetric. If A_k is in A_m , $k < m$, so by definition A_m is not in A_k .



Relative terms - 50

$$\text{Let } r = \left\{ (x, y) \in \mathbb{R} \times \mathbb{R} : 0 < \frac{1}{x + y} < 1 \right\}$$

Is r transitive or intransitive?

Relative terms – 50

Intransitive; consider $(-1, 3); (3, 0)$.

Then $0 < \frac{1}{-1+3} = \frac{1}{2} < 1$ and $0 < \frac{1}{3+0} = \frac{1}{3} < 1$

But $\frac{1}{-1+0} = -1 < 0$, so $(-1, 0) \notin r$



Mod squad- 10

What is the last digit of $(13)^2(17)^3$?

Mod squad 4 – 10

- Last digit of $13^2=9$
- Last digit of $17^3=4$
- So, 6



Mod Squad - 20

- Suppose that a number is multiplied by 4. The result has remainder 2 when divided by 5. If the number is less than 15 but greater than 10, what is the number?

Mod squad – 20

- $4x \equiv 2 \pmod{5}$
- $x \equiv 3 \pmod{5}$
- $10 < x < 15$ implies $x = 2(5) + 3 = 13$



Mod Squad - 30

- Can 3 be the last digit of any perfect square?

Mod Squad – 30

No; because of equivalence classes, we only need to look at $\{0^2 \pmod{10}, 1^2 \pmod{10}, \dots, 9^2 \pmod{10}\} = \{1, 4, 5, 6, 9\}$



Mod Squad - 40

Find a negative value for x :

$$3x \equiv 4(\text{mod } 5)$$

$$3x \equiv 2(\text{mod } 4)$$

Mod Squad – 40

$$3x \equiv 4(\text{mod } 5) \Rightarrow x \equiv 3(\text{mod } 5) \Rightarrow x = 5q + 3$$

$$3x \equiv 2(\text{mod } 4) \Rightarrow x \equiv 2(\text{mod } 4) \Rightarrow x = 4k + 2$$

$$5q + 3 = 4k + 2 \Leftrightarrow 5q - 4k + 1 = 0; k = -1, q = -1$$

$$5(-1) + 3 = -2 \text{ or } 4(-1) + 2 = -2$$

$$x = -2$$

Check your answer!



Mod Squad - 50

DAILY DOUBLE!

$$2x + y \equiv 4 \pmod{7}$$

$$x - y \equiv 1 \pmod{5}$$

What is the least positive solution (x, y) ?

Mod Squad – 50

Let $k, q \in \mathbb{Z}$. We have $2x + y - 4 = 7k, x - y - 1 = 5q$
 $\therefore 3x = 7k + 5q + 5; \therefore 3x \equiv 5(\text{mod } 7); x \equiv 4(\text{mod } 7)$

Let $x = 4$. Use either initial condition.

$$2(4) + y \equiv 4(\text{mod } 7) y \equiv -4 \equiv 3(\text{mod } 7)$$

$$\therefore x = 4, y = 3$$

Since 3 and 4 are both less than 5, these are the least positive solutions.

Note: this is harder than what will be on
your test



Free apps - 10

- It's Tuesday. What day of the week will it be 211 days from now?

Free apps – 10

- Wednesday. $211 \equiv 1 \pmod{7}$, so we will be one day further into the week.



Free apps - 20

- 21 people like pets. 11 people like dogs, 7 people like cats, and 3 people like neither. How many people like both dogs and cats?

Free apps – 20

- 0! $|(A \cup B)'| = 3$, so $|A \cup B| = 18$. But $|A \cup B| = |A| + |B| - |A \cap B|$, i.e. $18 = 11 + 7 - |A \cap B|$



Free apps - 30

- In a recent survey, 150 people like chocolate and dislike pie. If 200 people were surveyed, how many people dislike chocolate or like pie?

Free apps – 30

- $200 - 150 = 50$. This is an application of deMorgan's law for sets.



Free apps - 40

- A crank works two gears. The first gear has 5 spokes and moves 2 spokes every crank. The second gear has 7 spokes and moves 4 spokes with every crank. How many cranks are needed so that both gears are on their third spoke?

Free apps – 40

$$2x \equiv 3(\text{mod } 5) \Leftrightarrow x \equiv 4(\text{mod } 5)$$

$$4x \equiv 3(\text{mod } 7) \Leftrightarrow x \equiv 6(\text{mod } 7)$$

$$x - 4 = 5q; x - 6 = 7k$$

$$\therefore 5q - 7k = -2$$

$$\therefore q = 8, k = 6$$

$$\therefore x = 44$$



Free apps - 50

- Suppose there is an 8x8 grid which is numbered left to right, top to bottom. (So the second row, 2nd entry is numbered 10.) If x is the number on the grid, develop one modular equation and one normal equation that deliver (a,b) , which says that x is the a -th column and b -th row.

Free apps – 50

- Column: $x = a \pmod{8}$, $0 < a < 9$
- Row: $b = (x - a) / 8$

