

1.1-1.2 and 1.4: Propositions and Truth Values
Sets and Venn Diagrams, Logical Fallacies - SOLUTIONS

Group Activity

Have the reader in your group read each question and as a group, discuss your answer.

1. Discuss each statement and decide which are propositions. Circle or highlight them.

- a) Are you hungry?
- b) Janae was nominated for student council president.
- c) Four pounds less.
- d) $7 + 8 = 33$
- e) I have two siblings.



2. A proposition is given, represented by the letter p . Write the wording for the negation and double negation. (Note: not p can also be represented in symbols by $\sim p$.)

p : Hannah eats apples.

not p : **Hannah does not eat apples**

not not p : **Hanna refuses to not eat apples (you can be creative with this one)**

3. More Negations. Read the following and decide whether logging will continue. "The House failed to overturn a veto on a bill that would stop logging."

The bill would stop logging. The veto would continue logging. Overturning the veto would stop logging. Failing to overturn the veto continues logging.

4. Complete the truth table given the following propositions. Then explain what you ate for breakfast in each case.

p : I ate bacon for breakfast.

q : I ate eggs for breakfast.

p	q	$p \text{ and } q$	Explanation – What did you eat for breakfast?
T	T	T	I ate eggs and bacon
T	F	F	I ate bacon and not eggs
F	T	F	I ate eggs but not bacon
F	F	F	I ate neither eggs nor bacon

5. Given the conditional statement, complete the truth table. Refer to your notes for help if needed. (Note: "if p , then q " can be written in symbols as $p \rightarrow q$.)

"If I am elected, then I will reduce college tuition in Oregon."

p : I am elected

q : I will reduce college tuition in Oregon

p	q	if p , then q $p \rightarrow q$	Meaning – Have I kept my campaign promise?
T	T	T	I got elected and I reduced college tuition in Oregon. Yes, I kept my promise.
T	F	F	I got elected and I did not reduce college tuition in Oregon. No, I did not keep my promise.
F	T	T	I did not get elected and I reduced college tuition in Oregon. I did not promise anything about if I did not get elected so I have kept my promise and this is true.
F	F	T	I did not get elected and I did not reduce college tuition in Oregon. I did not promise anything about if I did not get elected so I have kept my promise and this is true.

6. Complete the truth table. Do one column at a time, using only the relevant columns.

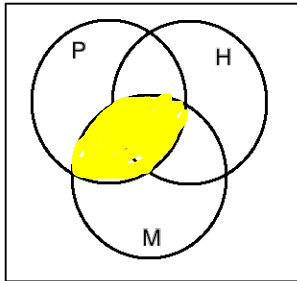
r	s	t	r and t	s or t	not (s or t)	If s then (r and t)	not r	If s then not r
T	T	T	T	T	F	T	F	F
T	T	F	F	T	F	F	F	F
T	F	T	T	T	F	T	F	T
T	F	F	F	F	T	T	F	T
F	T	T	F	T	F	F	T	T
F	T	F	F	T	F	F	T	T
F	F	T	F	T	F	T	T	T
F	F	F	F	F	T	T	T	T

1.2: Sets and Venn diagrams

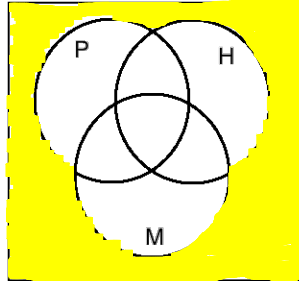
7. Pizza Venn Diagrams

Let P represent pepperoni, H represent ham, and M represent mushrooms. Shade or color in the appropriate area(s) for each pizza on the Venn diagrams below.

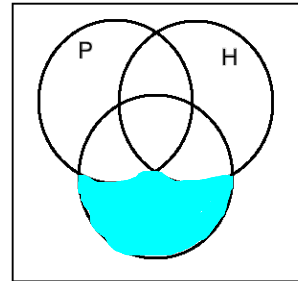
Pepperoni & Mushroom



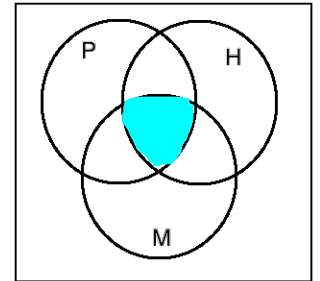
Cheese Pizza



Veggie



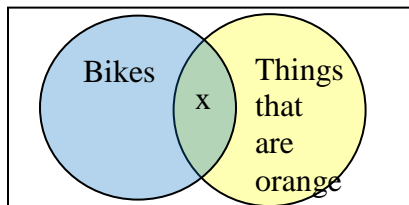
Supreme



Qualified Propositions

8. Draw a Venn diagram for each categorical or qualified proposition. Then write on the line whether the sets are disjoint, overlapping, or one is a subset of the other.

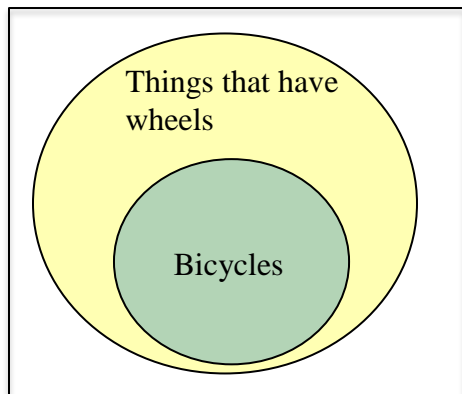
- a. Some bikes are orange.



Relationship between the Sets

Overlapping

- b. All bicycles have wheels.



Subset

9. Finding values for regions on a Venn diagram

150 people attending a concert were asked if they played piano, guitar, or drums.

10 could play all three.

73 could play guitar.

18 couldn't play any of these instruments.

21 could play piano and drums.

49 could play at least two of the instruments.

13 could play piano and guitar but not drums.

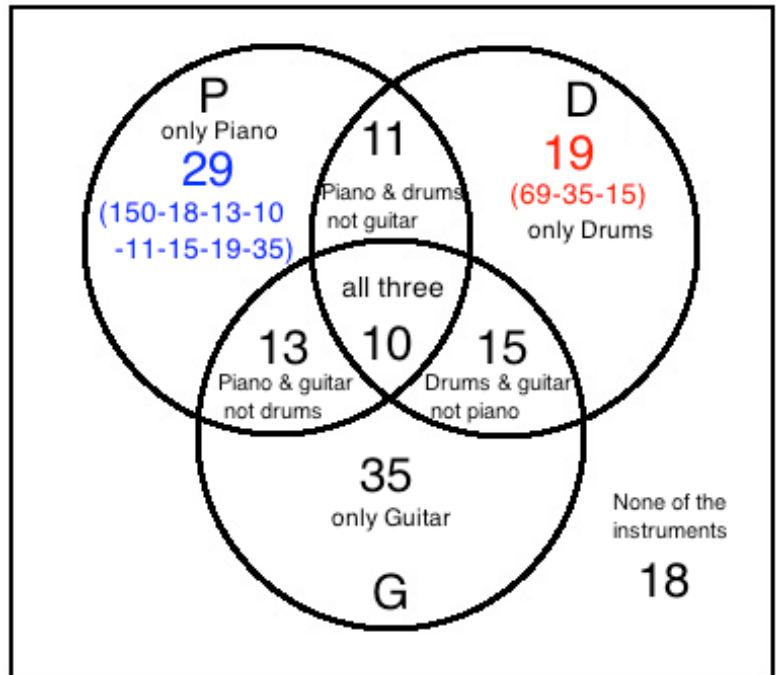
69 could play drums or guitar but not piano.

Let P represent piano,

G represent guitar, and

D represent drums.

Calculate and fill in the values for all eight regions.



More Practice

These problems can be used to check your understanding, help with online homework and study for tests. The answers can be found on my website.

1.1 Truth Values

1.. Pizza Truth Table

Let P represent pepperoni, H represent ham, and M represent mushrooms.

a. Complete each row by determining whether each statement is true or false. Don't worry about the meaning yet.

P	H	M	P and H	H or M	P and H and M	not P	not M	not P or not M
T	T	T	T	T	T	F	F	F
T	T	F	T	T	F	F	T	T
T	F	T	F	T	F	F	F	F
T	F	F	F	F	F	F	T	T
F	T	T	F	T	F	T	F	T
F	T	F	F	T	F	T	T	T
F	F	T	F	T	F	T	F	T
F	F	F	F	F	F	T	T	T

b. Now that you have the table filled in, Identify the row for each type of pizza given.

Pepperoni and Mushroom Pizza: Row **3**

Cheese Pizza: Row **8**

Veggie Pizza (peppers, onions, mushrooms, olives): Row **7**

Supreme Pizza (ham, pepperoni, sausage, olives, mushrooms, onions, peppers): Row **1**

c. Explain the result (T or F), in the context of the pizza and its toppings.

i. Row 8 Column 9

Not P or not M is true so the pizza either does not have pepperoni or does not have mushrooms or does not have either. Row 8 is the cheese pizza so that makes sense.

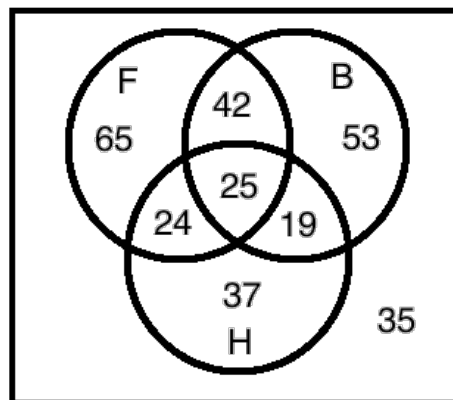
ii. Row 3 Column 4

P and H is false, so the pizza is missing either pepperoni or ham. Row 3 is the Pepperoni and Mushroom so it is missing the ham.

1.2 Sets and Venn Diagrams

2. A survey was taken to see which professional sports were watched by students. Let F represent football, B represent basketball, and H represent hockey.

Answer the following questions (use complete sentences).
Show any calculations that were used.



- a. How many students participated in the survey?

$$65 + 42 + 53 + 24 + 25 + 19 + 37 + 35 = 300$$

300 students took the survey.

- b. How many students watched basketball?

$$42 + 53 + 25 + 19 = 139$$

139 students watched basketball.

- c. How many students watched only one of the sports?

$$65 + 53 + 37 = 155$$

155 students watched only one of the sports.

- d. How many students watched at least two sports?

$$24 + 42 + 19 + 25 = 110$$

110 students watched at least two of the three sports.

- e. How many students didn't watch hockey?

$$300 - (24 + 25 + 19 + 37) = 195 \quad \text{OR} \quad 35 + 65 + 42 + 53 = 195$$

195 students didn't watch hockey.

- f. How many students watched football and hockey, but not basketball?

(this one can be found directly from the diagram)
24 students watched football and hockey, but not basketball.