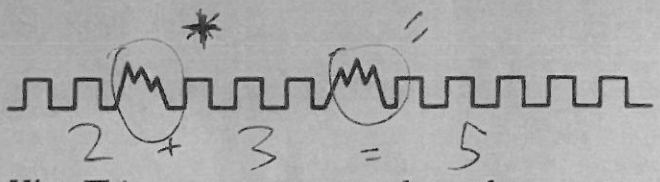
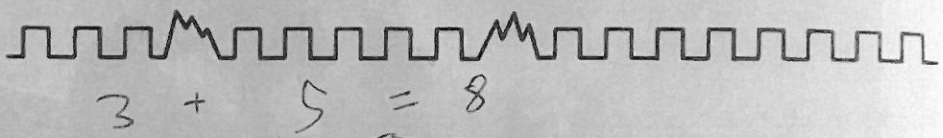
Theo Shin
(SID): 109477384

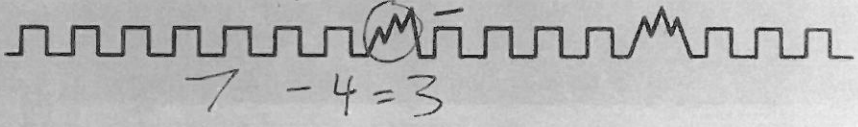
1. After you solve the following, describe as carefully as you can, your process for solving. Are you using inductive or deductive reasoning? Can you be sure your answer is correct?

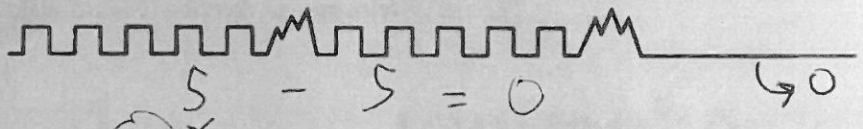
Here are diagrams of radio signals once suggested by a British physicist as a way of starting a conversation. Each line of pulses represents a mathematical statement. Can you figure out what the statements are?

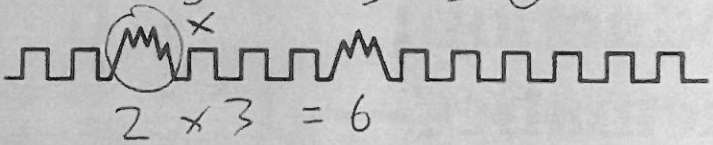
1. 

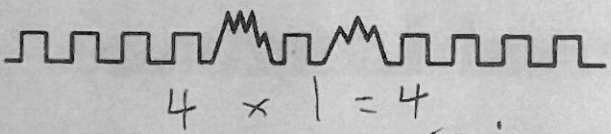
Hint: This message seems to have three parts, separated by two zigzag patterns. What does each part mean?

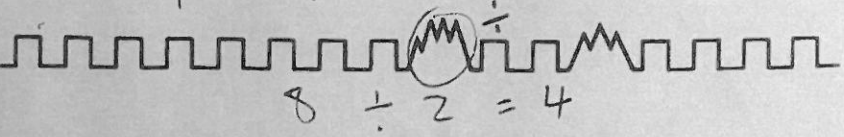
2. 

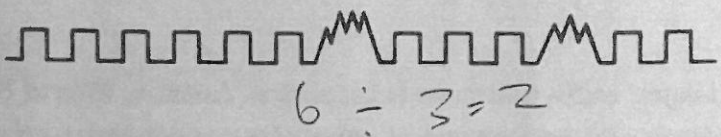
3. 

4. 

5. 

6. 

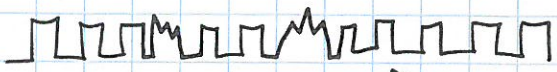
7. 

8. 

⎍ = 1 ⎍⎍ = 2

(Problem 1)

1. You can check by "Commutative" pattern



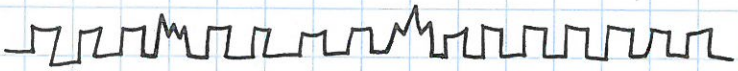
3 + 2 = 5

Inductive reasoning: I infered what the symbols suggested
Deductive reasoning: Tested Algebraic patterns to see if inferences held.

3. Inductive reasoning: Assign symbol to mean subtraction
Deductive reasoning:

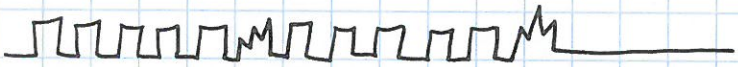
7 - 4 = 3

THEN knowing  means addition from questions 1 and 2:



3 + 4 = 7

4. Symbol for subtraction held true since



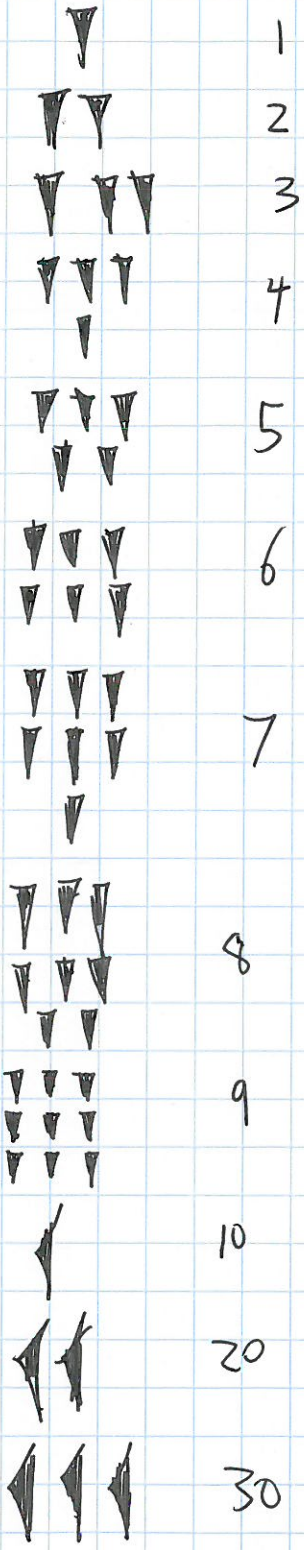
5 - 5 = 0

Produced zero pulses

5-8: Same logical principles were used to hypothesize what symbols inferred to and then tested, to determine means multiply and  means divide.

Problem 2

Left Hand Column



Right Hand Column

multiples of 9

9

~~18~~ 10 + 8 = 18

10 + 10 + 7 = 27

10 + 10 + 10 + 6 = 36

10 + 10 + 10 + 10 + 5 = 45

10 + 10 + 10 + 10 + 10 + 4 = 54

(60) + 3 = 63

60 + 10 + 2 = 72

60 + 10 + 10 + 1 = 81

60 + 10 + 10 + 10 = 90

Symbols hypothesized by inductive reasoning:

60 + 60 + 60 = 180

Deductive reasoning =


= 90 (60 + 10 + 10 + 10)


= 180 = (60 + 60 + 60)

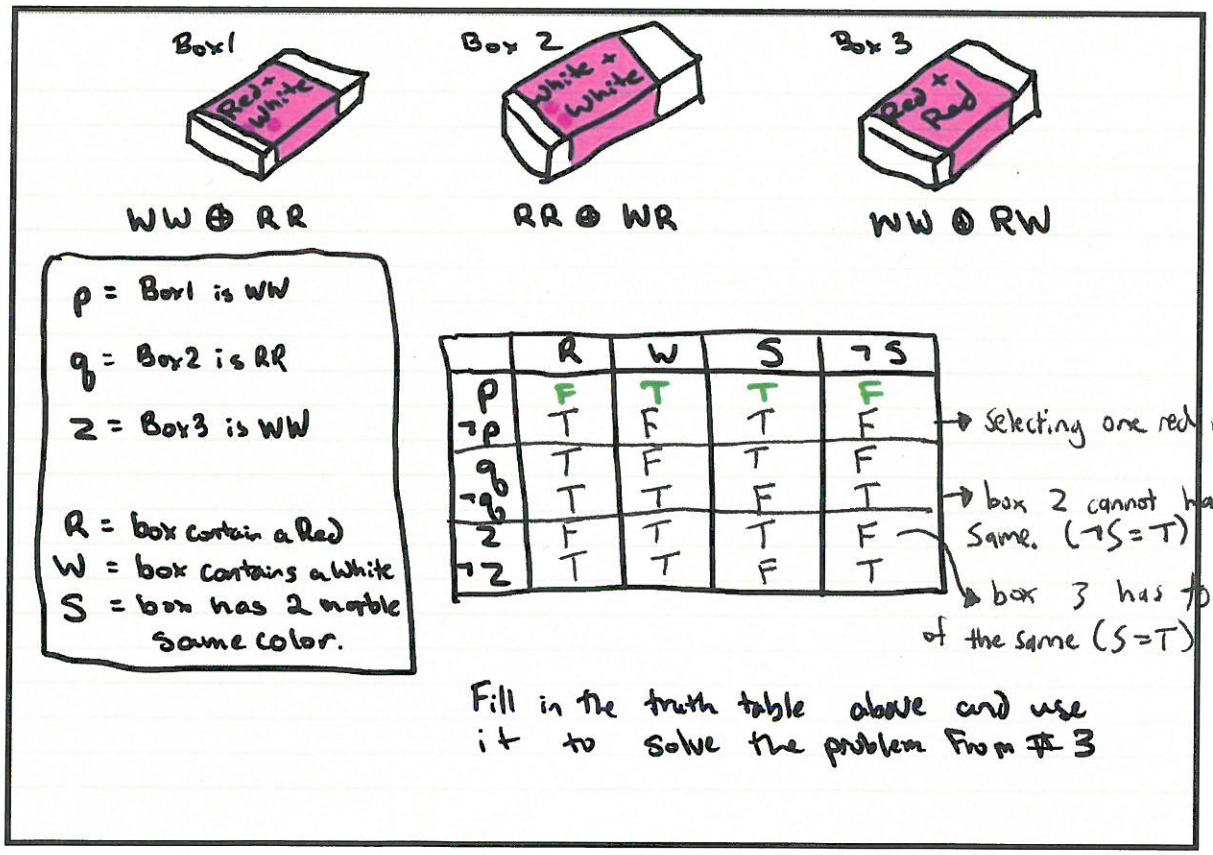

= 270 = (60 × 4) + (10 × 3)

Once symbols on left hand column were figured out, I used the same inferences for right hand column to derive/test solution.

3. Imagine you are given 3 matchboxes, labeled "Red and White," "Red and Red," and "White and White." Each box contains 2 marbles which can be either red or white. The labels on each box are incorrect. You are allowed to peek inside one box and look at exactly one marble in that box - and see if it is red or white. After this, can you figure out what is in each box? Does it matter which box you choose to open? Are you using inductive or deductive reasoning? Can you be sure of your answer? Explain in details. Use pictures if you like. Do not use a truth table.

4. Do not do number 4 until you have tried number 3. Below is one way you can set up a truth table to solve #3. There are lots of ways to do this. You may sketch your answers on the picture. *Notice we use logic several ways. We define what each box can be. Then create propositions that are useful. For example, we know box1 can be only be WW or RR. So if p = Box 1 is WW, we know that not p = Box 1 is RR. When solving the puzzle, we consider what happens if we see one R marble in box 1 and consider the implications for the table.*

   Do your best and make a good try. I'll give you full credit for an honest and sincere attempt even if it is not perfect.



	R	W	S	¬S
p	F	T	T	F
¬p	T	F	T	F
q	T	F	T	F
¬q	T	T	F	T
z	F	T	T	F
¬z	T	T	F	T

→ Selecting one red marble

→ box 2 cannot have two of the same. (¬S=T)

→ box 3 has to have two of the same (S=T)

Since we know selecting one red marble from box 1 means it contains 2 red marbles, we know only one red marble remains between boxes two and three.

problem 3. R+R R+W W+W

R+W → R+R or W+W

Pick a marble from R+W box because since its mislabelled, it has to be either 2 red or 2 white marbles. Assuming it is 2 red marbles, then ~~the~~ you are left with 1 red and 3 white marbles. The box W+W has to have 1 red marble since it is also mislabeled and you are left with R+R actually having 1 white and 1 red marble. This solution only works when choosing from R+W box ~~first~~. I would say I initially used inductive reasoning to conclude the R+W box would yield either 2 red or 2 white marbles, which simplifies the problem greatly. The deductive reasoning is my explanation of breaking down what happens if you select a red marble from the R+W box and discerning the W+W box contains the remaining red marble.

problem 4. Answer sketched on picture

problem 5. ① Albert ("I don't know") = He is the first one proiding a response so we know he wants water (otherwise he would have responded "Not everyone wants water" or "I don't want water"). Yet, Albert does not know whether Bob or Jose will want water.

② Bob ("I don't know") = Bob already knows Albert wants water due to his firm grasp on propositional logic but does not know Jose's choice. Again, if Bob did not want water he would state "Not everyone wants water."

③ Jose ("Not everyone wants water") = Last but not least, Jose knows Albert and Bob both want water yet states "not everyone wants water." Jose, being the last to respond means Jose is the only one who does not want water.

Albert = Water Bob = Water Jose = Something besides water

problem 6

p: I bought a lottery ticket this week
q: I won the million dollar jackpot

a) "I did not buy a lottery ticket this week"
b) "I bought a lottery ticket this week" or "I won the million dollar jackpot"
c) "If I bought a lottery ticket this week then I won the million dollar jackpot"
d) "I bought a lottery ticket this week and won the million dollar jackpot!"
e) "I bought a lottery ticket this week if and only if I won the million dollar jackpot"
f) "If I did not buy a lottery ticket this week then I did not win the million dollar jackpot"
g) "I did not buy a lottery ticket this week and I did not win the million dollar jackpot"
h) "I didn't buy a lottery ticket this week" or "I did buy a lottery ticket this week and won the million dollar jackpot"

problem 7

a)

p	$\neg p$	$p \wedge \neg p$
T	F	F
F	T	F

b)

p	$\neg p$	$p \vee \neg p$
T	F	T
F	T	T

c)

p	q	$\neg q$	$p \vee \neg q$	$(p \vee \neg q) \rightarrow q$
T	T	F	T	T
T	F	T	T	F
F	T	F	F	T
F	F	T	T	F

d)

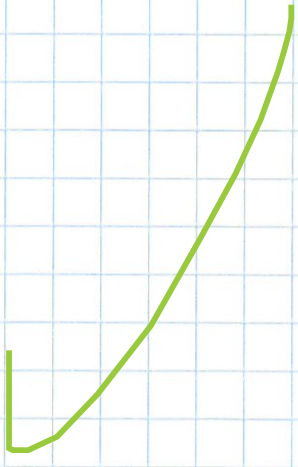
p	q	$p \vee q$	$p \wedge q$	$p \vee q \leftrightarrow p \wedge q$
T	T	T	T	T
T	F	T	F	F
F	T	T	F	F
F	F	F	F	T

e)

p	q	$\neg p$	$\neg q$	$p \rightarrow q$	$\neg q \rightarrow \neg p$	$(p \rightarrow q) \leftrightarrow (\neg q \rightarrow p)$
T	T	F	F	T	T	T
T	F	F	T	F	F	T
F	T	T	F	T	T	T
F	F	T	T	T	T	T

f)

p	q	$p \rightarrow q$	$q \rightarrow p$	$(p \rightarrow q) \rightarrow (q \rightarrow p)$
T	T	T	T	T
T	F	F	T	T
F	T	T	F	F
F	F	T	T	T



problem 8.

a)

101	1110	
010	0001	
111	1111	bitwise OR
000	0000	bitwise AND
111	1111	bitwise XOR

b)

1111	0000	
1010	1010	
1111	1010	OR
1010	0000	AND
0101	1010	XOR

c)

00	0111	0001	
10	0100	1000	
10	0111	1001	OR
10	0100	0000	AND
10	0011	1001	XOR

d)

11	1111	1111	
00	0000	0000	
11	1111	1111	OR
00	0000	0000	AND
11	1111	1111	XOR

problem 9.

conditional	$p \to q$	T
contrapositive	$\neg q \to \neg p$	F
		T
		T

MIRROR (equivalents on each side of mirror)

		T
inverse	$\neg p \to \neg q$	T
converse	$q \to p$	F
		T

problem 10.

Conditional - If Cody makes the field goal then the Bears win

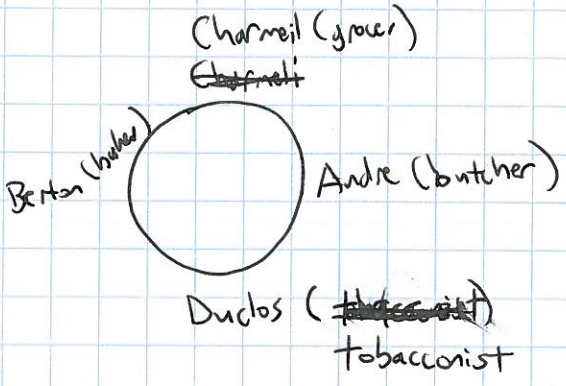
Contrapositive - If the Bears do not win then Cody does not make the field goal
"If the Bears lose then Cody missed the field goal"

Inverse - If Cody does not make the field goal then the Bears did not win
"If Cody misses the field goal the Bears lose"

Converse - If the Bears win then Cody makes the field goal
"Bears win because Cody makes the field goal"

Just for fun

(president) Andre = butcher
Charmeil = grocer
Berton = baker
Duclos = tobacconist



We know Andre sits to left of Charmeil so Charmeil sits at top of picture. Duclos sits across from Charmeil and is not the baker. This leaves Berton to sit in the remaining chair at the left of table. Since Berton sits at the right of Charmeil, Charmeil is the grocer. Berton has to be the baker because Duclos is not. That leaves Duclos being the tobacconist.