Webinar Module 2

Rules for writing programs Cf

- 1. Don't use new syntax
- 2. In the program, we should always expect the user follows instructions
  - Makes it easier for us to learn
  - Once basics are done, we could worry
- 3. Stick with format of the output

PROGRAM

Given the weight of two items.

For each item, give its weight in lbs. an oz seperated by a space

Item 1:	3	12
+ Item 2:	5	7
	9	3 (19)

Method #1

$19 \div 16 = 1 R 3$

19 div 16 = 1

19 mod 16 = 3

The combined weight is 9 lbs and 3 ounces

* Always think of strategy you want to implement

Method #2

1. Convert weight from lbs. & oz. to just oz.
2. Add oz. together
3. Then convert weight back

$p \vee q$

$\neg p \vee r$

$\therefore q \vee r$

↳ Applied when Both Assumptions Are T so our argument is T

p	q	r	$p \vee q$	$\neg p \vee r$	$q \vee r$	$\neg q \vee \neg r$
T	T	T	T	T	T	F
T	T	F	T	F	T	T
T	F	T	T	T	T	
T	F	F	T	F	F	F
F	T	T	T	T	T	T
F	T	F	T	T	T	T
F	F	T	F	T	T	T
F	F	F	F	T	F	

$p \vee q$

$\neg p \vee r$

$\therefore \neg q \vee r$

Not Valid

Use rules of inference and laws of propositional logic to prove

What is a Valid Justification?
- Quote a hypothesis as a statement
- Use rule of inference
- Use Logical Equivalences

h1 $(p \wedge q) \rightarrow r$
h2 $\neg r$
h3 q

$\therefore \neg p$

#	Statement	Justification
1	$(p \wedge q) \rightarrow r$	h1
2	$\neg r$	h2
3	$\neg(p \wedge q)$	Modus tollens on lines 2 & 1
4	$\neg p \vee \neg q$	Identity 9b (DeMorgan) on line 3
5	$\neg q \vee \neg p$	Identity 3a (Commutative) on line 4
6	q	h3
7	$\neg\neg q$	Identity 7 (Double Negation) on line 6
8	$\neg p$	Disjunctive Syllogism on lines 5 and lines 7

Basically we write series of statements to be true until we reach a true conclusion

Universal generalization: Most useful

- We Need to Conclude it Always works
- We take an arbitrary item. show $P(c)$ is true, therefore its always true

c is arbitrary element

$$\frac{P(c)}{\therefore \forall x\, P_x}$$

What is valid?

- Quote Hypothesis
- Rules of inference
- Logical Equivalences

And

- Arbitrary Elemental Variable from Domain

U = Set of People who live in a city

Linda lives in the city
Linda owns a Ferrari
Everyone who owns a Ferrari has gotten a speeding ticket

∴ Linda has gotten a speeding ticket

$F(x)$ = "x owns a Ferrari"
$S(x)$ = "x got a speeding ticket"

Linda is in U
F(Linda)
$\forall x\ F(x) \to S(x)$

∴ ~~F~~(Linda)

#	Statement	Justification
1	$\forall x\ F(x) \to S(x)$	h3
2	Linda is in U	h1
3	F(Linda) → S(Linda)	Universal Instantiation On 2 and 1
4	F(Linda)	h2
5	S(Linda)	Modus Ponens on lines 4 and 3

- You wont state "C(x)" for lives in city because the universe the argument implies is that.

U = the set of students in a class

Every student on the honor roll recieved an A
No student who got a detention recieved an A

∴ No Student who got a detention is on the honor roll

If we don't want a

$H(x)$ = "x is on honor roll"
$A(x)$ = "x got an A"
$D(x)$ = "x got a detention"

$$\forall x\, [H(x) \to A(x)]$$
$$\neg \exists x\, [D(x) \wedge A(x)] \equiv \forall x\, \neg [D(x) \wedge A(x)] \equiv \forall x\, [\neg D(x) \vee \neg A(x)]$$

$$\therefore \neg \exists x\, [D(x) \wedge H(x)] \equiv \quad \equiv \forall x\, [H(x) \to \neg D(x)]$$

#	Statement	Justification
1	c is an Abitrary Element	Element Introduction
2	$\forall x\, (H(x) \to A(x))$	h1
3	$H(c) \to A(c)$	universal Instation on lines 1&2
4	$\neg \exists x\, [D(x) \wedge A(x)]$	h2
5	$\forall x\, \neg [D(x) \wedge A(x)]$	DeMorgan on Line 4
6	$\neg [D(c) \wedge A(c)]$	Universal Instilization 1&5
7	$\neg D(c) \vee \neg A(c)$	DeMorgan on Line 6
8	$\neg A(c) \vee \neg D(c)$	~~3a Conditional~~ Commu on Line 7
9	$A(c) \to \neg D(c)$	Conditional on Line 8
10	$H(c) \to D(c)$	Hypothetical Syllogism

11	$\neg H(c) \lor \neg D(c)$	11a Line 10 Conditional
12	$\neg D(c) \lor \neg H(c)$	Commutative on 11
13	$\neg (D(c) \land H(c))$	DeMorgan line 12
14	$\forall x \neg D(x) \land H(x)$	Universal Generalization line 1 & 13
15	$\neg \exists x [D(x) \land H(x)]$	DeMorgan on Line 14