

Section 1

CSE 311 - Sp 2022

Administrivia & Introductions

Homework

- Submissions
 - LaTeX (highly encouraged)
 - overleaf.com
 - template and LaTeX guide posted on course website!
 - Word Editor that supports mathematical equations
 - Handwritten Neatly and scanned
- All homeworks will be turned in via Gradescope
- Homeworks typically due on Wednesdays at 10pm
- You have 6 late days **total** to use throughout the quarter
 - Anything beyond that will result in a deduction on further late assignments
- Only 3 late days max can be used per assignment

Propositions & Implications

Quick concept reviews!

- **Propositions** are statements with a boolean truth value!
 - “**The AQI of Seattle is 50**” is a proposition. We know it’s either true or false.
 - “**The AQI of Seattle?**” is not. Suddenly it could be hundreds of values.
 - In formal logic, we like to assign a proposition into a variable for later use.
- **Logical connectives** connect propositions to form new propositions!

$$\neg p$$

$$p \wedge q$$

$$p \vee q$$

$$p \rightarrow q$$

$$p \leftrightarrow q$$

$$p \rightarrow q$$

Implication:

p implies q

whenever p is true q must be true

if p then q

q if p

p is sufficient for q

p only if q

q is necessary for p

p	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

Problem 1 - Warm-Up

Steps:

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(a) If I am lifting weights this afternoon, then I do a warm-up exercise.

(b) If I am cold and going to bed or I am two-years old, then I carry a blanket.

Problem 1a - Warm-Up

Steps:

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(a) If I am lifting weights this afternoon, then I do a warm-up exercise.

Problem 1a - Warm-Up

Steps:

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(a) If I am lifting weights this afternoon, then I do a warm-up exercise.

Step 1

p: I am lifting weights this afternoon

q: I do a warm-up exercise

Problem 1a - Warm-Up

Steps:

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(a) If I am lifting weights this afternoon, then I do a warm-up exercise.

Step 1

p: I am lifting weights this afternoon

q: I do a warm-up exercise

Step 2

If p **then** q

Problem 1a - Warm-Up

Steps:

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(a) If I am lifting weights this afternoon, then I do a warm-up exercise.

Step 1

p: I am lifting weights this afternoon

q: I do a warm-up exercise

Step 2

If p **then** q

Step 3

$p \rightarrow q$

Practice

Problem 1b - Warm-Up

Steps:

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(b) If I am cold and going to bed or I am two-years old, then I carry a blanket.

Work on part (b) with the people around you, and then we'll go over it together!

Problem 1b - Warm-Up

Steps:

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(b) If I am cold and going to bed or I am two-years old, then I carry a blanket.

Problem 1b - Warm-Up

Steps:

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(b) If I am cold and going to bed or I am two-years old, then I carry a blanket.

Step 1

p: I am cold

q: I am going to bed

r: I am two-years old

s: I carry a blanket

NOTE: you need a subject for each proposition. “Going to bed” is not a proper proposition, you need to add the “I am” to make it a valid sentence, and thus a valid proposition!!!

Problem 1b - Warm-Up

Steps:

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(b) If I am cold and going to bed or I am two-years old, then I carry a blanket.

Step 1

p: I am cold

q: I am going to bed

r: I am two-years old

s: I carry a blanket

Step 2

If p **and** q **or** r, **then** s

Problem 1b - Warm-Up

Steps:

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(b) If I am cold and going to bed or I am two-years old, then I carry a blanket.

Step 1

p: I am cold

q: I am going to bed

r: I am two-years old

s: I carry a blanket

Step 2

If p **and** q **or** r, **then** s

Step 3

$[(p \wedge q) \vee r] \rightarrow s$

Problem 2 - If I can translate, then...

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(a) whenever I walk my dog, I make new friends.

(b) I will drink coffee, if Starbucks is open or my coffeemaker works.

(c) Being a U.S. citizen and over 18 is sufficient to be eligible to vote.

(d) I can go home only if I have finished my homework.

(e) Having an internet connection is necessary to log onto zoom.

(f) I am a student because I attend university.

Work on parts (a), (c), and (f) with the people around you, and then we'll go over them together!

Problem 2 - If I can translate, then...

1. Create propositional variables
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3. Replace the operators

(a) Whenever I walk my dog, I make new friends.

Problem 2 - If I can translate, then...

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(a) Whenever I walk my dog, I make new friends.

Step 1

p: I walk my dog

q: I make new friends

Problem 2 - If I can translate, then...

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(a) Whenever I walk my dog, I make new friends.

Step 1

p: I walk my dog

q: I make new friends

Step 2

Whenever p, q

Problem 2 - If I can translate, then...

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2. Replace all propositions with created variables
3. Replace the operators

(a) Whenever I walk my dog, I make new friends.

Step 1

p: I walk my dog

q: I make new friends

Step 2

Whenever p, q

If p **then** q

Problem 2 - If I can translate, then...

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(a) Whenever I walk my dog, I make new friends.

Step 1

p: I walk my dog

q: I make new friends

Step 2

Whenever p, q

If p **then** q

Step 3

$p \rightarrow q$

Problem 2 - If I can translate, then...

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(c) Being a U.S. citizen and over 18 is sufficient to be eligible to vote.

Problem 2 - If I can translate, then...

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(c) Being a U.S. citizen and over 18 is sufficient to be eligible to vote.

Step 1

p: One is a U.S. Citizen

q: One is over 18

r: One is eligible to vote

Problem 2 - If I can translate, then...

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(c) Being a U.S. citizen and over 18 is sufficient to be eligible to vote.

Step 1

p: One is a U.S. Citizen

q: One is over 18

r: One is eligible to vote

Step 2

Being p **and** q **is sufficient for** r

Problem 2 - If I can translate, then...

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(c) Being a U.S. citizen and over 18 is sufficient to be eligible to vote.

Step 1

p: One is a U.S. Citizen

q: One is over 18

r: One is eligible to vote

Step 2

Being p **and** q **is sufficient for** r

If p **and** q **then** r

Problem 2 - If I can translate, then...

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(c) Being a U.S. citizen and over 18 is sufficient to be eligible to vote.

Step 1

p: One is a U.S. Citizen

q: One is over 18

r: One is eligible to vote

Step 2

Being p **and** q **is sufficient for** r

If p **and** q **then** r

Step 3

$(p \wedge q) \rightarrow r$

Problem 2 - If I can translate, then...

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(f) I am a student because I attend university.

Problem 2 - If I can translate, then...

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(f) I am a student because I attend university.

Step 1

p: I am a student

q: I attend university

Problem 2 - If I can translate, then...

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(f) I am a student because I attend university.

Step 1

p: I am a student

q: I attend university

Step 2

p **because** q

Problem 2 - If I can translate, then...

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(f) I am a student because I attend university.

Step 1

p: I am a student

q: I attend university

Step 2

p **because** q

If q **then** p

Problem 2 - If I can translate, then...

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators

(f) I am a student because I attend university.

Step 1

p: I am a student

q: I attend university

Step 2

p **because** q

If q **then** p

Step 3

$q \rightarrow p$

Problem 5 - Tea Time

Consider the following sentence:

If I am drinking tea then I am eating a cookie, or, if I am eating a cookie then I am drinking tea.

- (a) Define propositional variables and translate the sentence into an expression in logical notation.
- (b) Fill out a truth table for your expression.

Work on this problem with the people around you, and then we'll go over them together!

Problem 5 - Tea Time

If I am drinking tea then I am eating a cookie, or, if I am eating a cookie then I am drinking tea.

- (a) Define propositional variables and translate the sentence into an expression in logical notation.

Problem 5 - Tea Time

If I am drinking tea then I am eating a cookie, or, if I am eating a cookie then I am drinking tea.

(a) Define propositional variables and translate the sentence into an expression in logical notation.

p: I am drinking tea

q: I am eating a cookie

Problem 5 - Tea Time

If I am drinking tea then I am eating a cookie, or, if I am eating a cookie then I am drinking tea.

(a) Define propositional variables and translate the sentence into an expression in logical notation.

p: I am drinking tea

q: I am eating a cookie

$(p \rightarrow q) \vee (q \rightarrow p)$

Problem 5 - Tea Time

If I am drinking tea then I am eating a cookie, or, if I am eating a cookie then I am drinking tea.

(a) Fill out a truth table for your expression. $(p \rightarrow q) \vee (q \rightarrow p)$

p	q	$p \rightarrow q$	$q \rightarrow p$	$(p \rightarrow q) \vee (q \rightarrow p)$

Problem 5 - Tea Time

If I am drinking tea then I am eating a cookie, or, if I am eating a cookie then I am drinking tea.

(a) Fill out a truth table for your expression. $(p \rightarrow q) \vee (q \rightarrow p)$

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

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If I am drinking tea then I am eating a cookie, or, if I am eating a cookie then I am drinking tea.

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

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T	F	F	T	T
F	T	T	F	T
F	F	T	T	T

That's All, Folks!

Any questions?