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!
  
  \[
  \neg p, \quad p \land q, \quad p \lor q, \quad p \rightarrow q, \quad p \leftrightarrow q
  \]
\[ p \rightarrow q \]

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 \( p \)

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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 → 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 ∧ q) ∨ r] → s
Problem 2 - If I can translate, then...

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

(a) Whenever I walk my dog, I make new friends.
Problem 2 - If I can translate, then…

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

**Step 1**

p: I walk my dog

q: I make new friends

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators
Problem 2 - If I can translate, then…

(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

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators
Problem 2 - If I can translate, then…

(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

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators
Problem 2 - If I can translate, then…

(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

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

(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…

(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

1. Create propositional variables
2. Replace all propositions with created variables
3. Replace the operators
Problem 2 - If I can translate, then…

(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 \land 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…

(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…

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

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

Step 1
p: I am a student
q: I attend university

Step 2
p because q
Problem 2 - If I can translate, then…

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

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

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…

(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.

\[ p: \text{I am drinking tea} \]
\[ q: \text{I am eating a cookie} \]

\[ (p \rightarrow q) \lor (q \rightarrow p) \]
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. \((p \rightarrow q) \lor (q \rightarrow p)\)

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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. \((p \rightarrow q) \lor (q \rightarrow p)\)

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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. 

\((p \to q) \lor (q \to p)\)

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(a) Fill out a truth table for your expression.  

\[(p \rightarrow q) \lor (q \rightarrow p)\]

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That’s All, Folks!

Any questions?