

# CSE 311 Section 1

## Propositional Logic

# **Administrivia & Introductions**



# Homework

- Submissions
  - LaTeX (highly encouraged)
    - [overleaf.com](https://overleaf.com) or [parchmynt.com](https://parchmynt.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 11:59 PM
- 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

# Parchmynt

B I U   <> <-> LaTeX     

## CSE 311 Homework 2

### Problem 1

a)  $\neg p$  using only one  $A$  gate  
 $\equiv A(1, p, 0)$

$p$	$\neg p$	$A(1, p, 0)$
0	1	1
1	0	0

b)  $p \vee q$  using only one  $A$  gate  
 $\equiv A(p, 0, q)$

$p$	$q$	$p \vee q$	$A(p, 0, q)$
1	1	1	1
1	0	1	1
0	1	1	1
0	0	0	0

c)  $p \wedge q$  using any number of  $A$  gates  
 $\equiv A(1, A(A(1, p, 0), 0, A(1, q, 0)), 0)$

$p$	$q$	$p \wedge q$	$A(1, p, 0)$	$A(1, q, 0)$	$A(A(1, p, 0), 0, A(1, q, 0))$
1	1	1	0	0	0
1	0	0	0	1	1
0	1	0	1	0	1

- Easily write LaTeX with the convenience of Word or Google Docs
- Removes tedium of writing complicated LaTeX syntax/equations
- Website: [parchmynt.com](http://parchmynt.com)
- Documentation: [parchmynt.com/documentation](http://parchmynt.com/documentation)
- 3 minute video instructions: [YouTube](#)

# Overleaf

```
35
36 \title{Homework 1: Propositional Logic}
37 \date{}
38
39 \begin{document}
40
41 \maketitle
42
43 \section{Due date: Wednesday July 2nd at 11:59 PM}
44
45 If you work with others (and you should!), remember to follow the
46 collaboration policy outlined in the
47 syllabus.
48
49 In general, you are graded on both the clarity and accuracy of your work.
50 Your solution should be clear enough that someone in the class who had
51 not seen the problem before would understand it.
52
53 We sometimes describe approximately how long our explanations are. These
54 are intended to help you understand approximately how much detail we are
55 expecting. You are allowed to have longer explanations, but explanations
56 significantly longer than necessary may receive deductions.
57
58 You should read the
59 grading
60 guidelines) on the assignments
61 page, but much of it will only be
62 relevant with later homeworks.
63
64 \newpage
65 \section{1. Syllabus}
66
67 Read the syllabus and/or watch "Lecture 1" on panopto until the 15:30 mark. If you have
68 any questions about the syllabus, ask us on Ed!
69
70 On your homework submission, write "I have watched lecture 1 and/or read
71 the syllabus, and agree to follow the collaboration and AI policies."
72 for full credit.
73
74 \begin{solution}
75
76 \end{solution}
```

- Standardized editor for writing LaTeX
- Potentially steeper learning curve but lots of documentation online
- Very useful in upper-level CS/Math classes
- Website: [overleaf.com](https://www.overleaf.com)
- Documentation: <https://www.overleaf.com/learn>

# Homework Templates

- For each homework, templates will be posted with outlines for each question
- You are not required to use the template, but it will help organize your work and make it easier for us to read your work :)
- For HW1, there are comments in the LaTeX for Question 2 that outline how to write common propositional logic symbols

```
% Uncomment the following lines to see how to write the common symbols.  
% This is the symbol for ``implies``:  $\rightarrow$   
% This is the symbol for ``and``:  $\wedge$   
% This is the symbol for ``or``:  $\vee$   
% This is the symbol for ``neg``:  $\neg$ 
```

# Announcements & Reminders

- Sections are Graded
  - You will be graded on section participation, so please try to come 😊
  - When you can't come to section, do the problems on the calendar and email your TA by Sunday with your solutions (more details on Ed)
- Section Materials
  - Handouts will be provided in at each section
  - Worksheets and sample solutions will be available on the course calendar later this evening
- HW1
  - Due Wednesday July 2

# Your TAs

- TA 1
  - content
- TA 2
  - content

# Tips for 311!

- Tackling challenging homework problems may feel intimidating at first but **don't go at it alone!** Find study groups, join us in office hours, and ask questions on Ed.
- Section will often be challenging and fast but valuable for your learning. **This is your time to ask lots of questions and clarify your learning!**
- Sometimes homework problems will mirror section problems, use that to your advantage!
- This class is the best time to learn how to use LaTeX. Please consider learning now as it will save you time for future courses! Feel free to come to office hours to get help with LaTeX!
- This class moves quickly, so the sooner you identify gaps in your learning, the better. (Don't wait to discover gaps in your learning in the final week)

# Icebreaker

- Small groups of 4-6ish
- Please share with your group
  - Your name
  - Number of years in department/ at UW
  - What was something fun you plan to do over Summer break?
  - What are you concerned about for 311 / what are you excited about?
- Then, share how you like to eat your potatoes (baked, fried, chips, etc.)
- We'll go around and see what style of potato is most popular!

# Propositions & Implications



# Quick Concept Review

- **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!

$$\neg p$$

$$p \wedge q$$

$$p \vee q$$

$$p \rightarrow q$$

$$p \leftrightarrow q$$

# Truth Tables

Gives us a simple way to describe how logical connectives operate

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

$p$	$q$	$p \wedge q$
T	T	T
T	F	F
F	T	F
F	F	F

$p$	$q$	$p \vee q$
T	T	T
T	F	T
F	T	T
F	F	F

# Implications

Some common formulations:

$p$  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  $p$

# Implications

Some common formulations:

$p$  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

Vacuous truths: a false hypothesis, but true truth value

# “Only if”

I attended my 8:30am class **only if** I woke up early

Which is equivalent?

If I woke up early then I attended my 8:30 am class

or

If I attended my 8:30 am class then I woke up early



# “Only if”

I attended my 8:30am class **only if** I woke up early

If I woke up early then I attended my 8:30 am class

**NOT Equivalent:** The original statement **does not specify** what happens **when you wake up early**, you can wake up early to go play tennis in the morning!

If I attended my 8:30 am class then I woke up early

**Equivalent:** The original statement only **specifies exactly** what happened **when you went to your 8:30 class**, you had to have woken up early. Nothing else could have happened for you to be attending the 8:30 class.



# Problem 1a



# 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

$p \rightarrow q$

# Problem 1b



# Problem 1b

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

# Problem 1b

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

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

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

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



## 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.

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

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

## Problem 2 – If I can translate, then...

a) Whenever I walk my dog, 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

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...

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

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.

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

### 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.

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

### 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...

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

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

### 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...

f) I am a student because I attend university.

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

## 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

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

## 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  $p$

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

## 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

$q \rightarrow p$

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

# Problem 4



## Problem 4 – Look Both Ways

For each of the following, define propositional variables and translate the sentences into logical notation.

- a) Watching Naruto is necessary and sufficient to having a good weekend only if I got less than 7 hours of sleep.
- b) If berries are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area.
- c) Unless I am trying to type something, my cat is either eating or sleeping.

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

# Problem 4 – Look Both Ways

a) Watching Naruto is necessary and sufficient to having a good weekend only if I got less than 7 hours of sleep.

## Step 1

p: I watched Naruto

q: I had a good weekend

r: I got less than 7 hours of sleep

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

# Problem 4 – Look Both Ways

a) Watching Naruto is necessary and sufficient to having a good weekend only if I got less than 7 hours of sleep.

## Step 1

p: I watched Naruto

q: I had a good weekend

r: I got less than 7 hours of sleep

## Step 2

1. p is necessary and sufficient for q only if r.
2. (p if and only if q) only if r.
3. If (p if and only if q) then r.

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

# Problem 4 – Look Both Ways

a) Watching Naruto is necessary and sufficient to having a good weekend only if I got less than 7 hours of sleep.

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

## Step 1

p: I watched Naruto

q: I had a good weekend

r: I got less than 7 hours of sleep

## Step 2

1. p is necessary and sufficient for q only if r.
2. (p if and only if q) only if r.
3. If (p if and only if q) then r.

## Step 3

1.  $p \leftrightarrow q$

2.  $(p \leftrightarrow q) \rightarrow r$

# Problem 4 – Look Both Ways

b) If berries are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area.

## Step 1

$p$  : Berries are ripe along the trail

$q$  : Hiking is safe

$r$  : Grizzly bears have not been seen in the area

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

# Problem 4 – Look Both Ways

b) If berries are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area.

## Step 1

$p$  : Berries are ripe along the trail

$q$  : Hiking is safe

$r$  : Grizzly bears have not been seen in the area

## Step 2

1.  $q$  if and only if  $r$

2. If  $p$ , then  $q$  if and only if  $r$

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

# Problem 4 – Look Both Ways

b) If berries are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area.

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

## Step 1

$p$  : Berries are ripe along the trail

$q$  : Hiking is safe

$r$  : Grizzly bears have not been seen in the area

## Step 2

1.  $q$  if and only if  $r$

2. If  $p$ , then  $q$  if and only if  $r$

## Step 3

1.  $q \leftrightarrow r$

2.  $p \rightarrow (q \leftrightarrow r)$

# Problem 4 – Look Both Ways

c) Unless I am trying to type something, my cat is either eating or sleeping.

## Step 1

$p$  : I am trying to type something

$q$  : My cat is eating

$r$  : My cat is sleeping

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

# Problem 4 – Look Both Ways

c) Unless I am trying to type something, my cat is either eating or sleeping.

## Step 1

$p$  : I am trying to type something

$q$  : My cat is eating

$r$  : My cat is sleeping

## Step 2

1. Unless  $p$ , either  $q$  or  $r$

2. If not  $p$ , then  $q$  “exclusive or”  $r$

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

# Problem 4 – Look Both Ways

c) Unless I am trying to type something, my cat is either eating or sleeping.

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

## Step 1

$p$  : I am trying to type something

$q$  : My cat is eating

$r$  : My cat is sleeping

## Step 2

1. Unless  $p$ , either  $q$  or  $r$
2. If not  $p$ , then  $q$  “exclusive or”  $r$

## Step 3

1.  $\neg p$
2.  $\neg p \rightarrow (q \oplus r)$

## **Problem 5 (Bonus if time)**



# 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 it 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.

b) 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.

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

<b>p</b>	<b>q</b>	<b><math>p \rightarrow q</math></b>	<b><math>q \rightarrow p</math></b>	<b><math>(p \rightarrow q) \vee (q \rightarrow p)</math></b>
T	T			
T	F			
F	T			
F	F			

# 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.

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

<b>p</b>	<b>q</b>	<b><math>p \rightarrow q</math></b>	<b><math>q \rightarrow p</math></b>	<b><math>(p \rightarrow q) \vee (q \rightarrow p)</math></b>
T	T	T		
T	F			
F	T			
F	F			

# 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.

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

<b>p</b>	<b>q</b>	<b><math>p \rightarrow q</math></b>	<b><math>q \rightarrow p</math></b>	<b><math>(p \rightarrow q) \vee (q \rightarrow p)</math></b>
T	T	T		
T	F	F		
F	T			
F	F			

# 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.

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

<b>p</b>	<b>q</b>	<b><math>p \rightarrow q</math></b>	<b><math>q \rightarrow p</math></b>	<b><math>(p \rightarrow q) \vee (q \rightarrow p)</math></b>
T	T	T		
T	F	F		
F	T	T		
F	F	T		

# 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.

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

<b>p</b>	<b>q</b>	<b><math>p \rightarrow q</math></b>	<b><math>q \rightarrow p</math></b>	<b><math>(p \rightarrow q) \vee (q \rightarrow p)</math></b>
T	T	T	T	
T	F	F	T	
F	T	T	F	
F	F	T	T	

# 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.

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

<b>p</b>	<b>q</b>	<b><math>p \rightarrow q</math></b>	<b><math>q \rightarrow p</math></b>	<b><math>(p \rightarrow q) \vee (q \rightarrow p)</math></b>
T	T	T	T	T
T	F	F	T	
F	T	T	F	
F	F	T	T	

# 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.

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

<b>p</b>	<b>q</b>	<b><math>p \rightarrow q</math></b>	<b><math>q \rightarrow p</math></b>	<b><math>(p \rightarrow q) \vee (q \rightarrow p)</math></b>
T	T	T	T	T
T	F	F	T	T
F	T	T	F	
F	F	T	T	

# 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.

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

<b>p</b>	<b>q</b>	<b><math>p \rightarrow q</math></b>	<b><math>q \rightarrow p</math></b>	<b><math>(p \rightarrow q) \vee (q \rightarrow p)</math></b>
T	T	T	T	T
T	F	F	T	T
F	T	T	F	T
F	F	T	T	T

# 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.

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

<b>p</b>	<b>q</b>	<b><math>p \rightarrow q</math></b>	<b><math>q \rightarrow p</math></b>	<b><math>(p \rightarrow q) \vee (q \rightarrow p)</math></b>
T	T	T	T	T
T	F	F	T	T
F	T	T	F	T
F	F	T	T	T

# **That's All, Folks!**

**Thanks for coming to section this week!**  
**Any questions?**