

## Another Example

How about: If you are English, then you are a bad cook.

© 2005-09, N. Van Cleave

р	q	$\textbf{p} \rightarrow \textbf{q}$
		T or F?
you are English	you are a bad cook	
you are English	you are not a bad cook	
you aren't English	you are a bad cook	
you aren't English	you are not a bad cook	

## Another Example

## And finally: If you are a college student,

then you are immature.

p	9	$\textbf{p} \rightarrow \textbf{q}$
		T or F?
you are a college student	you are immature	
you are a college student	you aren't immature	
you aren't a college student	you are immature	
you aren't a college student	you aren't immature	

© 2005-09, N. Van Cleave

5

Truth Table for the Conditional If p, then q	Notes
pq $p \rightarrow q$ TTTTFFTTFFF	p → q is false only when the antecedent is true and the consequent is false
If the moon is made of green cheese,	$\clubsuit$ If the antecedent is <code>false</code> , then $p \to q$ is automatically <code>true</code>
If my name isn't < My name here >	
If I finish my homework,	$\clubsuit$ If the consequent is <code>true</code> , then $p \to q$ is automatically <code>true</code>
If I had a million dollars,	
If wishes were fishes,	
© 2005-09, N. Van Cleave 7	© 2005-09, N. Van Cleave 8

ר ר

true	or false?
$\_$ true $\rightarrow$ (6 = 6)	(6 = 6) → true
<u>true</u> $\rightarrow$ (6 = 3)	$(6=3) \rightarrow true$
$\underline{\qquad false} \rightarrow (6=6)$	(6 = 6) → false
$\underline{\qquad \qquad \text{false}} \rightarrow (6=3)$	(6=3) → false
Let p,q,	and r be false
( p $\rightarrow$ q)	(p $\rightarrow$ ~ q)
( $\sim$ r $\rightarrow$ q)	(p $\rightarrow$ $\sim$ q) $\rightarrow$ ( $\sim$ r $\rightarrow$ q)
© 2005-09, N. Van Cleave	9

Г

	<b>Truth Table:</b> $(\sim p \rightarrow \sim q) \rightarrow (\sim p \land q)$								
р	q	$\sim {\rm p}$	$\sim$ q	$\sim p \rightarrow \sim q$	$\sim p \wedge q$	$(\sim p \rightarrow \sim q) \rightarrow (\sim p \land q)$			
Т	Т								
Т	F								
F	Т								
F	F								

 $\textbf{Truth Table:} \quad (p \rightarrow q) \rightarrow (\sim p \lor q)$ 

р	q	$\textbf{p} \rightarrow \textbf{q}$	$\sim {\rm p}$	$\sim$ p $\lor$ q	( p $\rightarrow$ q ) $\rightarrow$ ( $\sim$ p $\lor$ q )
Т	Т				
Т	F				
F	Т				
F	F				

 $\ensuremath{\text{Tautology:}}$  a statement that is always true, no matter what the truth values of the components.

10

© 2005-09, N. Van Cleave

<b>Truth Table:</b> $p \lor \sim p$	p	q	$\sim p$	»   ~	q   ~ p ∨	~ q	$\sim$ (q $\land$ p)	(~ p	$\vee \sim$ q) $\rightarrow ~\sim$	(q ^ p)
$\mathbf{p} \sim \mathbf{p}  \mathbf{p} \lor \sim \mathbf{p}$	Т	Т								
	Т	F								
F	F	Т								
	F	F								
<b>Truth Table</b> : $p \rightarrow p$		┢	т Т	F						
Truth Table: $p \rightarrow p$			Т	Т						
$\begin{array}{ c c c } p & \sim p & p \rightarrow p \end{array}$			F	т Т						
Т			- F	- F						
F			•	•						
	Paca	II. Vo		a nat	home by	midn	ich+			
	Recu	n. 70 V	oua	renc	t around	ed	iigni,			
				. CC +k	n gi cuita	lea na	cult and	+huc +	ha nacation	



- \* If you are not home by midnight, then you'll be grounded.
- \* If he hits a home run, (then) he'll beat the old record.
- \* If you scratch my back, (then) I'll scratch yours.

© 2005-09, N. Van Cleave

\* If you exceed the speed limit, (then) you'll get a ticket.

- \* If that is an authentic Persian rug, I'll be surprised.
- \* If you give your plants tender, loving care, they flourish.
- If she doesn't, he will.

© 2005-09, N. Van Cleave

15

\* If you are a student, then you are immature.





16

Equival Used to	ent Sim	Statements plify Circuits	
$p \lor T$	≡	т	
$p\wedgeF$	$\equiv$	F	
$p \lor \sim p$	≡	Т	
$p\wedge\simp$	≡	F	
$p \lor p$	≡	р	
$p\wedgep$	≡	р	
$\sim$ (p $\wedge$ q)	≡	$\sim p \lor \sim q$	
$\sim$ (p $\lor$ q)	≡	$\sim p \wedge \sim q$	
$p \lor (q \land r)$	≡	$(p \lor q) \land (p \lor r)$	
$p \land (q \lor r)$	≡	$(p \land q) \lor (p \land r)$	
$p \to q$	$\equiv$	$\sim$ q $\rightarrow$ $\sim$ p	
$p \to q$	≡	$\sim p \lor q$	
© 2005-09, N. Van Cleave			

Draw a circuit for: $p \lor (\sim q \land \sim r)$	
Draw a circuit for $p \rightarrow (q \land \sim r)$ . (Rewrite it first)	