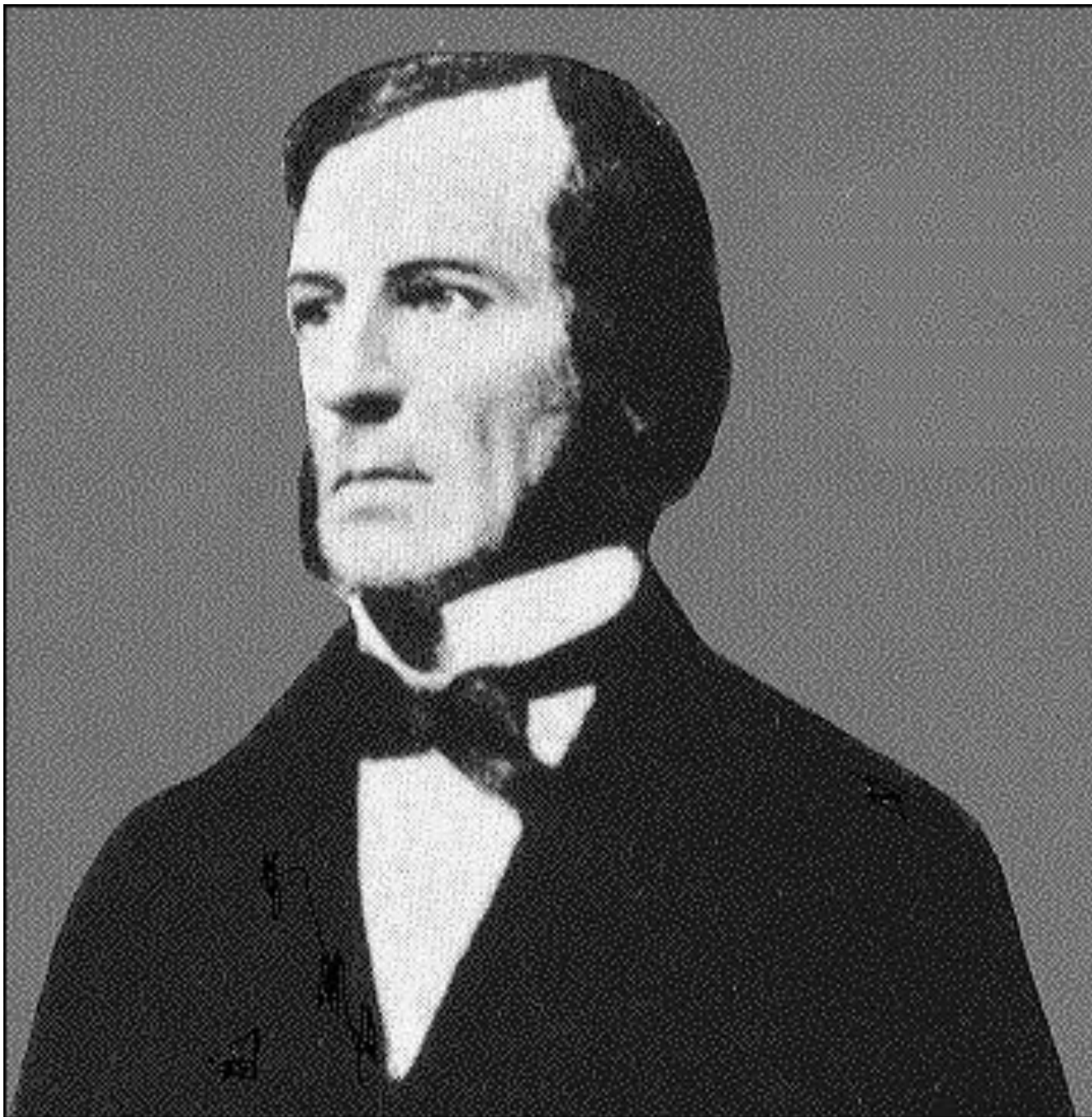


Boolean Algebra

Result in a True or False

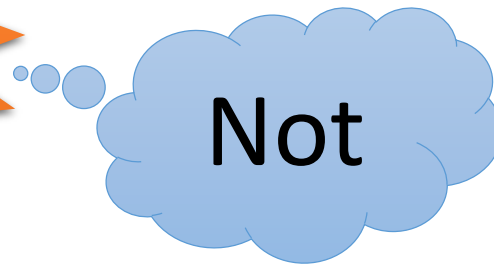
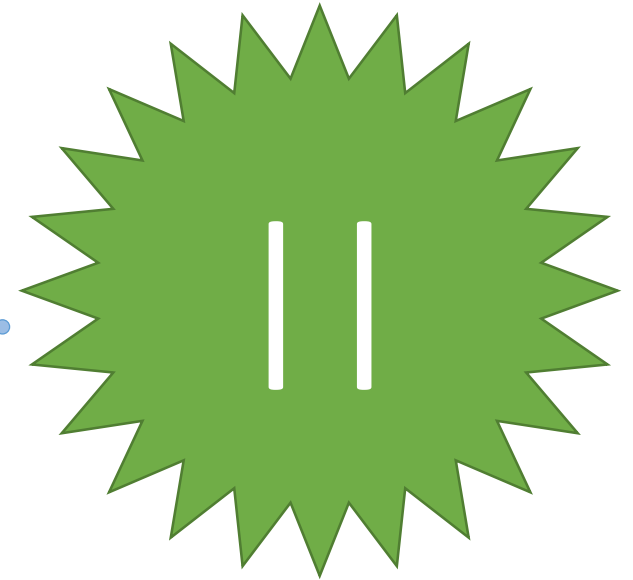
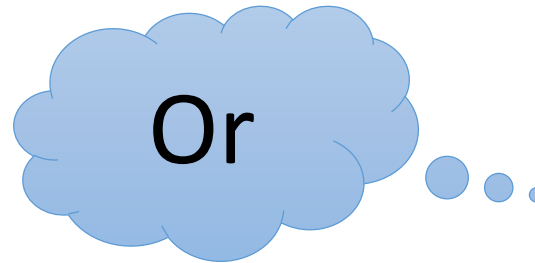
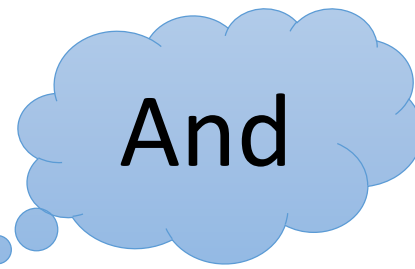
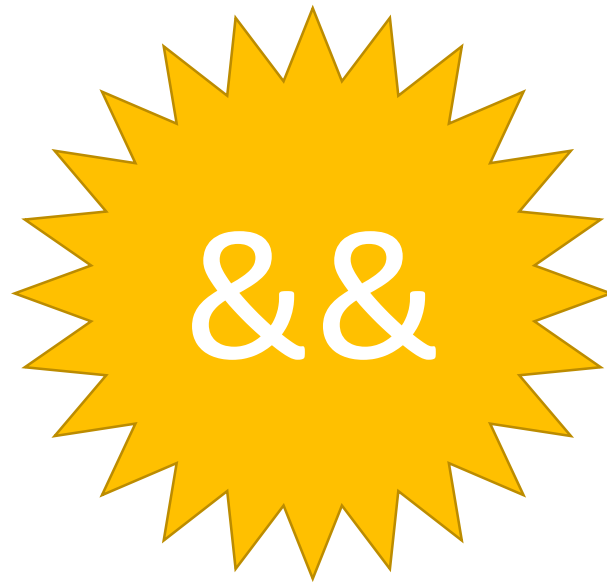


Named for
George
Boole
1815-1865

Boolean Algebra

- Mathematical expressions that results in either true or false.
- They can be joined to make more complex Boolean expression using Boolean Operators like AND, OR, NOT.
- They are used to control if statements and loops. This means that Boolean Algebra is one of the cornerstones of computer science.

Some Java
Symbols
for you...



2. What do each of the following Boolean operators mean?

&&		
!		

Can you read
this shirt now?

2b || !2b

Boolean Algebra evaluates
to only two answers.



Relational Operators

Operator	Meaning
>	Greater than
>=	Greater than or equal to
<	Less than
<=	Less than or equal to
==	Equal to
!=	Not equal to
.equals()	Equal for strings

1. What do each of the following relational operators mean?

==	
!=	
>	
>=	
<	
<=	

The variable `num` holds the value of `5`.
Are these true or false?



`num > 6`

The variable `num` holds the value of `5`.
Are these true or false?

`num > 6`

F

`num >= 5`

The variable `num` holds the value of `5`.
Are these true or false?

`num > 6`

F

`num >= 5`

T

`num != 6`

The variable `num` holds the value of `5`.
Are these true or false?

`num > 6`

F

`num < 2`

`num >= 5`

T

`num != 6`

T

The variable `num` holds the value of `5`.
Are these true or false?

`num > 6`

F

`num < 2`

F

`num >= 5`

T

`num == 4`

`num != 6`

T

The variable `num` holds the value of `5`.
Are these true or false?

`num > 6`

F

`num < 2`

F

`num >= 5`

T

`num == 4`

F

`num != 6`

T

`!(num==3)`

The variable `num` holds the value of `5`.
Are these true or false?

`num > 6`

F

`num >= 5`

T

`num != 6`

T

`num < 2`

F

`num == 4`

F

`!(num==3)`

T

The variable `num` holds the value of `5`.
Are these true or false?

`num > 6`

F

`num >= 5`

T

`num != 6`

T

`num < 2`

F

`num == 4`

F

`!(num==3)`

T

The variable `num` holds the value of `5`.
Are these true or false?

`num > 6`

F

`num < 2`

F

`num >= 5`

T

`num == 4`

F

`num != 6`

T

`!(num==3)`

T

The variable `num` holds the value of `5`.
Are these true or false?

`num > 6`

F

`num >= 5`

T

`num != 6`

T

`num < 2`

F

`num == 4`

F

`!(num==3)`

T

The variable `num` holds the value of `5`.
Are these true or false?

`num > 6`

F

`num >= 5`

T

`num != 6`

T

`num < 2`

F

`num == 4`

F

`!(num==3)`

T



Says: "Yes or no? I won't take anything else for an answer!"


BOOLE ORDERS LUNCH



NO, NO, YES, NO, NO, YES,
YES, NO, NO, NO, YES...

Menu

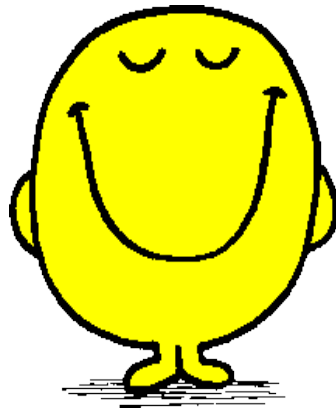
Mrs. Harris

A young girl with brown hair in a ponytail, wearing a purple top and blue jeans, is sitting on the shoulders of a woman. The woman has long brown hair and is wearing a grey top and blue jeans. Both are smiling and looking at each other. A blue speech bubble is positioned above the woman's head.

Would you like some
cake && ice cream?

Depending on what
you give them, the kid
is either happy or sad.

True



False





&&



=



&&

=

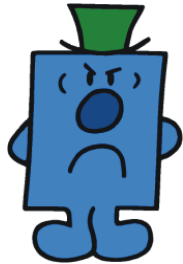


Where's my ice cream?

&&



=



Where's my cake?

&&

=



Where's my cake and ice cream?

And Truth Table

Value 1		Value 2		Answer
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

3. Evaluate the following.

a) What is the symbol for and? ___	AND		OR
b) What is the symbol for or? ___	f) What is T && T? ___		j) What is T T? ___
c) What is the symbol for not? ___	g) What is T && F? ___		k) What is T F? ___
d) What is !T? ___	h) What is F && T? ___		l) What is F T? ___
e) What is !F? ___	i) What is F && F? ___		m) What is F F? ___

If x is 4 and y is 7...

Evaluate

$(x > 3) \ \&\& \ (x < 9)$

				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

If x is 4 and y is 7...

Evaluate

$(x > 3) \ \&\& \ (x < 9)$
 $= (4 > 3) \ \&\& \ (4 < 9)$

				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

If x is 4 and y is 7...

Evaluate

$(x > 3) \ \&\& \ (x < 9)$
 $= (4 > 3) \ \&\& \ (4 < 9)$
 $= T \ \&\& \ T$

				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

If x is 4 and y is 7...

Evaluate

$(x > 3) \ \&\& \ (x < 9)$
 $= (4 > 3) \ \&\& \ (4 < 9)$
 $= T \ \&\& \ T$
 $= T$

				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

If x is 4 and y is 7...

Evaluate

$(x > 3) \ \&\& \ (x < 9)$
 $= (4 > 3) \ \&\& \ (4 < 9)$
 $= T \ \&\& \ T$
 $= T$

				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F



What can go in the
recycling bin?
Paper || Plastic



==



==



==



==



==



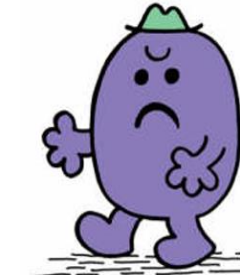
==



==



==



OR Truth Table

Value 1		Value 2		Answer
T		T	=	T
T		F	=	T
F		T	=	T
F		F	=	F

3. Evaluate the following.

a) What is the symbol for and? ___	AND		OR
b) What is the symbol for or? ___	f) What is T && T? ___		j) What is T T? ___
c) What is the symbol for not? ___	g) What is T && F? ___		k) What is T F? ___
d) What is !T? ___	h) What is F && T? ___		l) What is F T? ___
e) What is !F? ___	i) What is F && F? ___		m) What is F F? ___

If x is 4 and y is 7...

Evaluate

$(x==3) \ || \ (y>9)$

				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

				Ans
T		T	=	T
T		F	=	T
F		T	=	T
F		F	=	F

If x is 4 and y is 7...

Evaluate

$(x==3) \ || \ (y>9)$
 $= (4==3) \ || \ (7>9)$

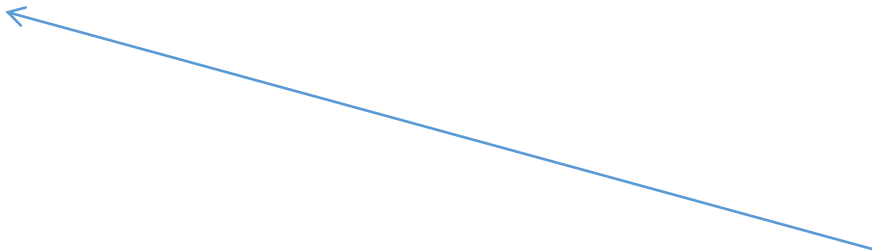
				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

				Ans
T		T	=	T
T		F	=	T
F		T	=	T
F		F	=	F

If x is 4 and y is 7...

Evaluate

$(x==3) \ || \ (y>9)$
 $= (4==3) \ || \ (7>9)$
 $= F \ || \ F$



				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

				Ans
T		T	=	T
T		F	=	T
F		T	=	T
F		F	=	F

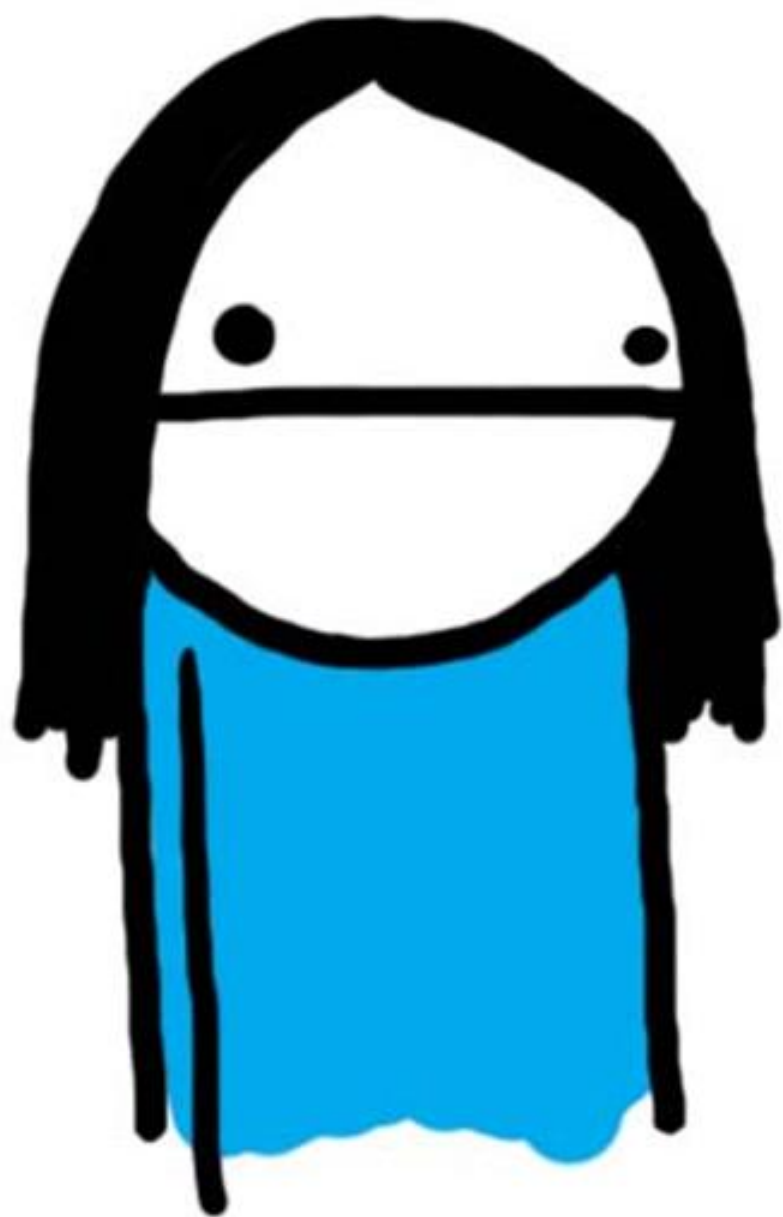
If x is 4 and y is 7...

Evaluate

$(x==3) \ || \ (y>9)$
 $= (4==3) \ || \ (7>9)$
 $= F \ || \ F$
 $= F$

				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

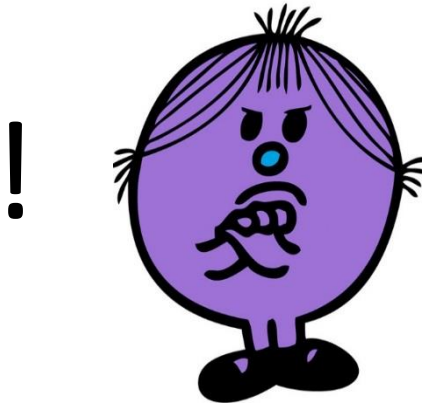
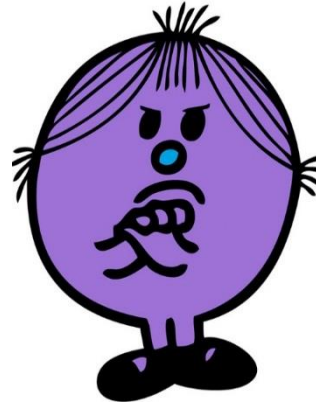
				Ans
T		T	=	T
T		F	=	T
F		T	=	T
F		F	=	F



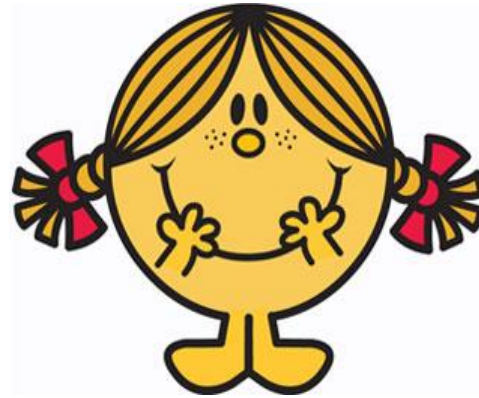
! talking
to
you.



=



=



NOT Truth Table

Value		Answer
!T	=	F
!F	=	T

3. Evaluate the following.

a) What is the symbol for and? ___	AND	OR
b) What is the symbol for or? ___	f) What is T && T? ___	j) What is T T? ___
c) What is the symbol for not? ___	g) What is T && F? ___	k) What is T F? ___
d) What is !T? ___	h) What is F && T? ___	l) What is F T? ___
e) What is !F? ___	i) What is F && F? ___	m) What is F F? ___

If x is 4 and y is 7...

Evaluate

$!(!(x \leq 7) \ \&\& \ !(y \neq 9))$

				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

				Ans
T		T	=	T
T		F	=	T
F		T	=	T
F		F	=	F

		Ans
!T	=	F
!F	=	T

If x is 4 and y is 7...

Evaluate

$!(!(x \leq 7) \&\& !(y \neq 9))$
 $= !(!(4 \leq 7) \&\& !(7 \neq 9))$

				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

				Ans
T		T	=	T
T		F	=	T
F		T	=	T
F		F	=	F

		Ans
!T	=	F
!F	=	T

If x is 4 and y is 7...

Evaluate

$!(!(x \leq 7) \&\& !(y \neq 9))$
 $= !(!(4 \leq 7) \&\& !(7 \neq 9))$
 $= !(!T \&\& !T)$

				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

				Ans
T		T	=	T
T		F	=	T
F		T	=	T
F		F	=	F

		Ans
!T	=	F
!F	=	T

If x is 4 and y is 7...

Evaluate

$$\begin{aligned} &!(!(x \leq 7) \ \&\& \ !(y \neq 9)) \\ &= !(!(4 \leq 7) \ \&\& \ !(7 \neq 9)) \\ &= !(!T \ \&\& \ !T) \\ &= !(F \ \&\& \ F) \end{aligned}$$

				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

				Ans
T		T	=	T
T		F	=	T
F		T	=	T
F		F	=	F

		Ans
!T	=	F
!F	=	T

If x is 4 and y is 7...

Evaluate

$!(!(x \leq 7) \ \&\& \ !(y \neq 9))$
 $= !(!(4 \leq 7) \ \&\& \ !(7 \neq 9))$
 $= !(!T \ \&\& \ !T)$
 $= !(F \ \&\& \ F)$
 $= !F$

				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

				Ans
T		T	=	T
T		F	=	T
F		T	=	T
F		F	=	F

		Ans
!T	=	F
!F	=	T

If x is 4 and y is 7...

Evaluate

$!(!(x \leq 7) \ \&\& \ !(y \neq 9))$
 $= !(!(4 \leq 7) \ \&\& \ !(7 \neq 9))$
 $= !(!T \ \&\& \ !T)$
 $= !(F \ \&\& \ F)$
 $= !F$
 $= T$

				Ans
T	&&	T	=	T
T	&&	F	=	F
F	&&	T	=	F
F	&&	F	=	F

				Ans
T		T	=	T
T		F	=	T
F		T	=	T
F		F	=	F

		Ans
!T	=	F
!F	=	T

5. In each pair, circle the one which creates the correct code to make a Boolean Expression.

(a) `one => two`

or

`one >= two`

(b) `one = two`

or

`one == two`

(c) `one > two > three`

or

`one > two && two > three`

8. Write a Boolean expression to represent each of the following:

(a) x is greater than 34 _____

(b) x is less than or equal to 25 _____

(c) x is not equal to 3 _____

(d) x is between 1 and 12 _____

(e) x is over 17 _____

(f) x is under 17 _____

(g) x equals 3 or 5 _____

(h) x equals 5 or 9 _____

9. AND expressions.

If I want x to be between 1 and 4, I write $(x \geq 1 \ \&\& \ x \leq 4)$.

Fill in the following.

a) x is between 5 and 9 _____

b) x is between 4 and 10 _____

c) x is between 2 and 100 _____

d) x is between 6 and 99 _____

Some
jokes.



**YOU CAN'T
HANDLE
THE BOOLEAN!**

You can't handle
the truth!



**an
inconvenient
boolean**

**the crisis of
global variables**

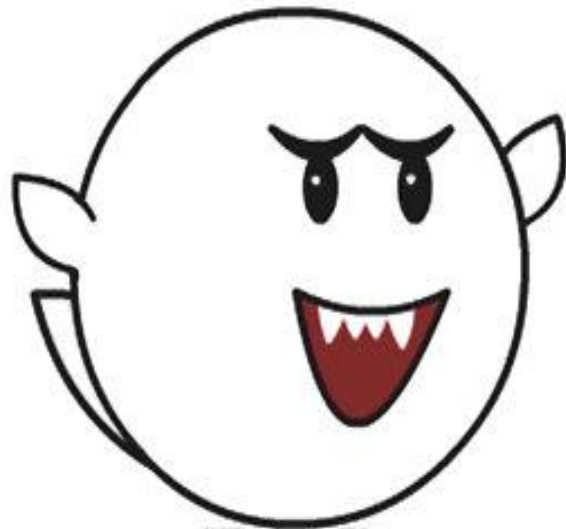


Adapted for **A NEW GENERATION**
from the *New York Times* Bestseller

**an
inconvenient
truth**

**the crisis of
global warming**

AL GORE



BOO



BOOLEAN

GILDAN
Ultra Cotton

programmer joke:

!false

It's funny
because it's true