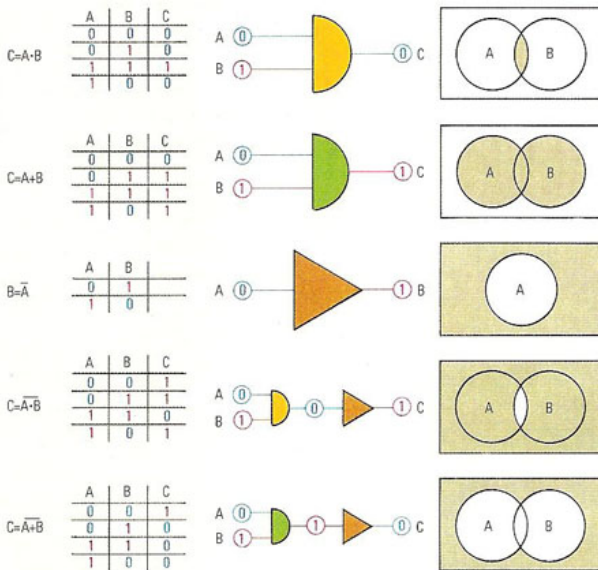


CS102: Boolean Logic and Relation Operators

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Boolean Algebra



Boolean Data Type

Declaration

```
bool A;
```

```
bool B;
```

```
bool C;
```

Boolean Data Type

Declaration

```
bool A;
```

```
bool B;
```

```
bool C;
```

Assignment

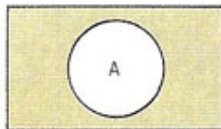
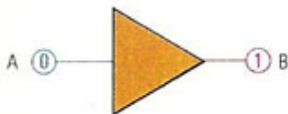
```
A = true;
```

```
B = false;
```

Boolean Algebra: Not

$$B = \bar{A}$$

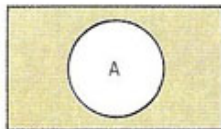
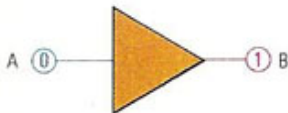
A	B
0	1
1	0



Boolean Algebra: Not

$$B = \bar{A}$$

A	B
0	1
1	0



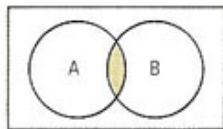
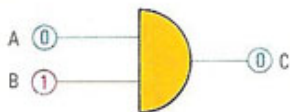
C++

$B = \text{!}A;$

Boolean Algebra: And

$$C = A \cdot B$$

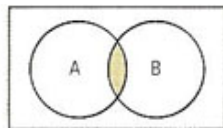
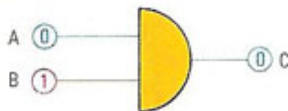
A	B	C
0	0	0
0	1	0
1	1	1
1	0	0



Boolean Algebra: And

$$C = A \cdot B$$

A	B	C
0	0	0
0	1	0
1	1	1
1	0	0



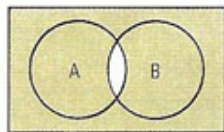
C++

$$C = A \&\& B$$

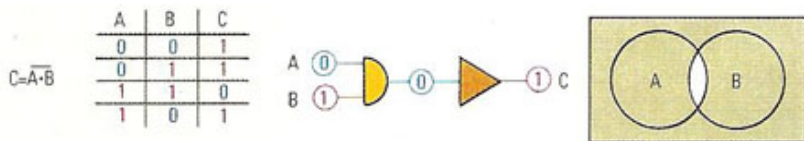
Boolean Algebra: Not And

$$C = \overline{A \cdot B}$$

A	B	C
0	0	1
0	1	1
1	1	0
1	0	1



Boolean Algebra: Not And



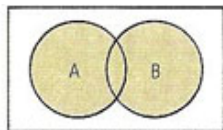
C++

$C = \neg(A \& B)$

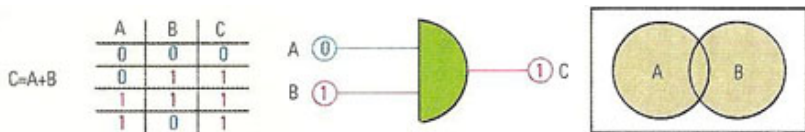
Boolean Algebra: Or

$$C = A + B$$

A	B	C
0	0	0
0	1	1
1	1	1
1	0	1



Boolean Algebra: Or



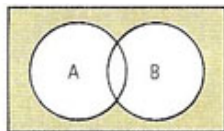
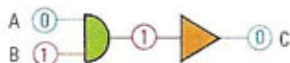
C++

$$C = A || B$$

Boolean Algebra: Not Or

$$C = \overline{A+B}$$

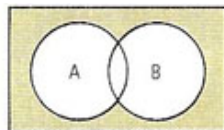
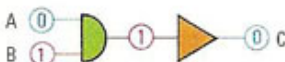
A	B	C
0	0	1
0	1	0
1	1	0
1	0	0



Boolean Algebra: Not Or

$$C = \overline{A+B}$$

A	B	C
0	0	1
0	1	0
1	1	0
1	0	0



C++

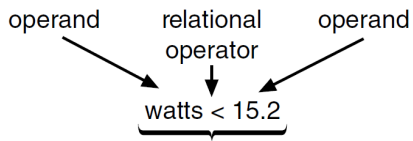
$$C = !(A||B)$$

De Morgan's Law

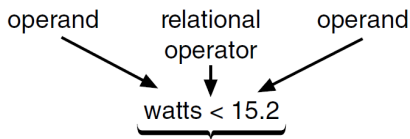
$$\neg(A \wedge B) = (\neg A \vee \neg B)$$

$$\neg(A \vee B) = (\neg A \wedge \neg B)$$

Relational Operator



Relational Operator



Operator	Meaning
<	less than
<=	less than or equal
>	greater than
>=	greater than or equal
==	equal
!=	not equal

Comparing Characters

- comparison is done between ASCII encodings
- words are compared on a character basis
- C++ provides functions for comparing characters

Comparing Doubles and Floats

Roundoff Errors

FALSE $1/3.0 == 0.3333333333333333$

TRUE $1/3.0 == 0.3333333333333333$

Comparing Doubles and Floats

Roundoff Errors

FALSE $1/3.0 == 0.3333333333333333$

TRUE $1/3.0 == 0.3333333333333333$

Avoiding Roundoff Errors

- $\text{abs}(1/3.0 - 0.3333333333333333) < \text{epsilon}$
- epsilon is a constant set to a teeny tiny value

Practice

Write relational expressions to express the following conditions (using variable names of your choosing):

- The distance is equal to 30 feet.
- The ambient temperature is 86.4 degrees.
- A speed is 55 mph.
- The current month is 12 (December).
- The letter input is K.
- A length is greater than 2 feet and less than 3 feet.
- The current day is the 15th day of the 1st month.
- The automobiles speed is 35 mph and its acceleration is greater than 4 mph per second.
- An automobiles speed is greater than 50 mph and it has been moving for at least 5 hours.
- The code is less than 500 characters and takes more than 2 microseconds to transmit.