## **Logical expressions**

- Why logical expression?
- Value of logical expression  $\rightarrow$  Boolean value : **true**, **false** (true: 1, false: 0)
- bool variable

Example: bool jobDone; bool taxable;

• logical operators

Relational	Equility	Logical	
< less than	== equal to	&&	and
<= less than and equal to	!= not equal to		or
> greater than		!	not
>= greater than and equal to			

## notes:

- 1. no space between the two symbols in : <=, >=, !=, ==
- 2. difference between = (assignment operator) and == (equal to operator) example:

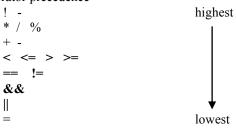
int A=1, B=2; bool C; A=B; 
$$C = (A==B);$$

• logical operation truth table

X	!x	
false	true	
true	false	

X	у	x&&y	$\mathbf{x}    \mathbf{y}$
true	true	true	true
true	false	false	true
false	true	false	true
false	false	false	false

• Operator precedence



• In C++, logical expressions are evaluate in a "short circuit fashion":

It sets the resulting value as soon as it is known, the expression may not be completely evaluated.

## Practice questions:

• Evaluate the following logical expressions:

```
int x=5, y=-3, z=2;
float A=3.0, B=2.5;
char student = 'S', teacher = 't', chairman='c';
string firstTeam = "UT", secondTeam="Vanderbilt";
a (x>z) == (A>B)
```

- b student < teacher != firstTeam < secondTeam
- c  $(x \le z) && (student != teacher)$
- d A !=B || firstTeam != secondTeam
- e !(x < (y+7))
- f = !(x>y) || ((y+z)>= (x-z))
- Write C++ logical statement to express the following:
  - a a patient's blood pressure is below 70, and above 55 inclusive (55<=bloodPressure<=70)
  - b the student's first lab or the second lab score is 100
  - c The difference between the two radius measurements is less than 0.001
  - d The number is a multiple of 3 or it is greater than 100
  - e The number is divisible by 5 and it is a multiple of 10
- Write the equivalent logical expression by applying the DeMorgan's law to the following expressions:
  - a ! (year%100 == 3 && month == 12)
  - b ! (taxRate > 0.35 || income < 80000)