CSD1100

Programming With Boolean Expressions

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Boolean Types

- C
  - None, use `int` instead (`typedef`, `#define`)
- C++ / C#
  - `bool`
- Java
  - `boolean`

Boolean Values

- C
  - `0` as false, and all the rest as true
- C++ / C# / Java
  - `true` / `false`

Logical Operators

- C / C++ / C# / Java / JavaScript
  - NOT → !
  - AND → &&
  - OR → ||

Example on C

```
int a = 5;
int b = 20;

if ( a && b )
    printf("Condition is true\n");
```

Example on C

```
int a = 5;
int b = 20;

if ( a || b )
    printf("Condition is true\n");
```

Example on C

```
int a = 5;
int b = 20;

/* lets change the value of a and b */
a = 0;
b = 10;

if ( a && b )
  printf("Condition is true\n");
else
  printf("Condition is not true\n");
```

Example on C

```
int a = 5;
int b = 20;

/* lets change the value of a and b */
a = 0;
b = 10;

if ( !(a && b) )
  printf("Condition is true\n");
```

Comparison Operators

Operator	Relationship Tested
<	First operand less than second operand
>	First operand greater than second operand
<=	First operand less than or equal to second operand
>=	First operand greater than or equal to second operand
==	First operand equal to second operand
!=	First operand not equal to second operand

Equivalent Expressions

`if (a<b && c<d) …`	`if (a<b)` `  if (c<d) …`
`if (a!=0 && b/a > 5) …`	`if (a && b/a > 5) …`
`if (!a) …`	`if (a==0) …`
`if (!(a>b)) …`	`if (a<=b) …`
`if (!(a>b && c<d)) …`	`if (a<=b || c>=d) …`

What is wrong?

```
int a = 5;
int b = 20;

if ( a = b )
  printf("Condition is true\n");
else
  printf("Condition is not true\n");
```

- Why output is "`Condition is true`"?

What is wrong?

```
int t = -20;

/* Check t in the range */
if ( 0 <= t <= 100 )
  printf("In the range\n");
else
  printf("Out of the range\n");
```

- Why output is "`In the range`"?

Conditional Operator

- Conditional operator ? : can be used to replace if else statements

```
int main() {
    int i = 1, j = 2;
    cout << ( i > j ? i : j )
         << " is greater." << endl;
    return 0;
}
```

Note: this example demonstrates how to output in C++

Practice 1

- Given a truth table for inputs X,Y and output Y.
- Create c code that implements this logic

X	Y	Z
0	0	1
0	1	0
1	0	0
1	1	1

Practice 2

- Let's calculate roots for a quadratic equation for given a, b, and c

$$ax^2 + bx + c = 0$$

- Solution:

$$x1 = (-b + \sqrt{(b^2 - 4ac)}) / 2a$$

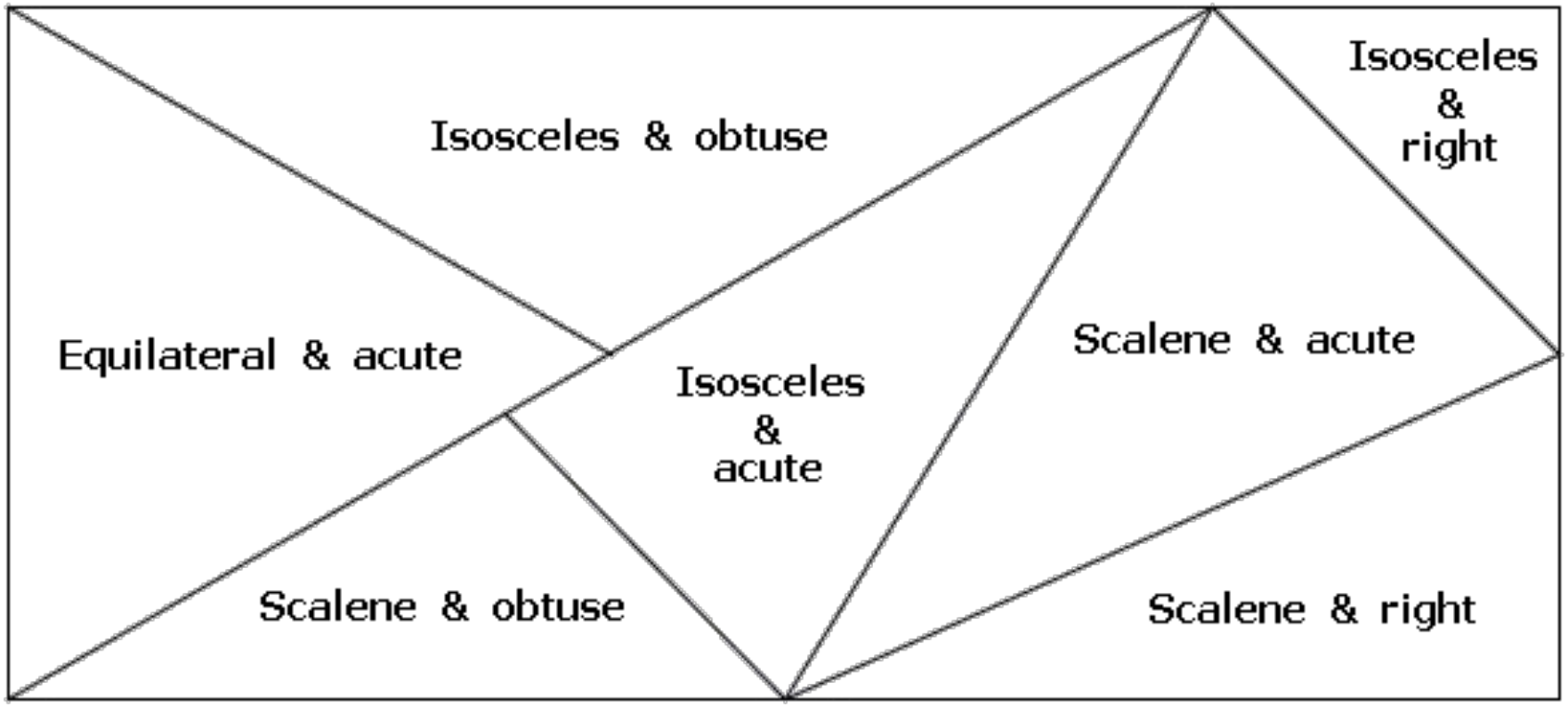
$$x2 = (-b - \sqrt{(b^2 - 4ac)}) / 2a$$

- Make sure:
  - discriminant is not a negative number
  - a in not a 0

Practice 3

- Write a program that classifies triangles depending on relative sizes of their elements: sides and angles
  - As regard their sides, triangles may be
    - Scalene (all sides are different)
    - Isosceles (two sides are equal)
    - Equilateral (all three sides are equal)
  - And as regard their angles, triangles may be
    - Acute (all angles are acute)
    - Right (one angle is right)
    - Obtuse (one angle is obtuse)
    - Equiangular (all angles are equal)

Practice 3



References

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