**De Morgan’s Law**

**Notes & Practice Worksheet**

**!(a && b) == (!a || !b)**

**!(a || b) == (!a && !b)**

Augustus De Morgan (1806 – 1871) introduced the logic laws for any condition **a** and **b**:

This law can be thought of as the

**Distributive Property** **for Logic Operators**

Consider the following example, (assume nice and funny are boolean variables):

if (!(funny && nice))

 System.out.println(“not my friend”);

could also be written as:

if ((!funny || !nice))

 System.out.println(“not my friend”);

**1. Complete the following truth table to prove De Morgan’s Law.**

|  |  |  |  |
| --- | --- | --- | --- |
| nice | funny | !(funny && nice) | (!funny || !nice) |
| true | true |  |  |
| true | false |  |  |
| false | true |  |  |
| false | false |  |  |

**2. Use De Morgan’s Law to write the equivalent condition of the given condition, assume all variables have been defined and initialized appropriately.**

|  |  |
| --- | --- |
| given condition | equivalent condition |
| !((count != 0) || (ave != 10)) |  |
| !(!found && (count > 0)) |  |
| (count >= 10 || !found) |  |
| (ave < 0 || !found) |  |
| (!(count >= 0) && (ave < 100)) |  |

**Counting Iterations**

**Notes & Practice Worksheet**

There are two types of bounds for loops, symmetric and asymmetric, defined by the terminating condition.

|  |  |
| --- | --- |
| **Symmetric** | **Iterations** |
| for(i = a; i <= b; i++) | b – a + 1 iterations |
| for(i = 5; i <= 95; i++) | 95 – 5 + 1 = 91 iterations |
| for(i = 0; i <= 1521; i++) | 1521 – 0 + 1 = 1522 iterations |

|  |  |
| --- | --- |
| **Asymmetric** | **Iterations** |
| for(i = a; i < b; i++) | b – a iterations |
| for(i = 6; i < 100; i++) | 100 – 6 = 94 iterations |
| for(i = 0; i < 255; i++) | 255 - 0 = 255 iterations |

|  |  |
| --- | --- |
| **Different Increment Values** | **Iterations** |
| for(i = a; i <= b; i += c) | (b – a)/c + 1 iterations |
| for(i = a; i < b; i += c) | (b – a)/c iterations |
| for(i = 20; i < 50; i += 3) | (50 – 20)/3 = 10 iterations |

**How many times will the following loops execute?**

1. for(i = -35; i <= 175; i++) 2. for(i = 100; i > -50; i--)

3. for(i = -10; i <= 10; i = i + 3) 4. for(i = 0; i < 1520; i += 2)

5. for(i = 0; i <= 4; i ++) 6. for(i = 0; i < 20; i ++)

for(j = 0; j < 5; j++) for(j = 0; j <= 11; j++)