**Solutions for Practice Exercises on Page 465**

**Note: Symbol ^ means XOR**

* **x ^ 0 = x 🡪(1)**

XORing with 0 gives you back the same number.

Example: Truth Table of x

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 0 | x | x | x ^ 0 | x ^ x |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 |

**x ^ x = 0 🡪(2)**

XORing x with itself gives you 0. That's because **x** is either 0 or 1, and **0 ^ 0 = 0** and **1 ^ 1 = 0**.

* XOR is associative.

That is: **(x ^ y) ^ z = x ^ (y ^ z)**

You can verify this by using truth tables.

**Exercise 9.3.6**

**Drawing twice in XOR mode equals not drawing at all**

**Show that (A XOR B) XOR B is A itself.**

**Solution:**

(A ^ B) ^ B = A ^ (B ^ B) (by Assoc)

= A ^ 0 (by B ^ B = 0, property **🡪(2)** )

= A (by A ^ 0 = A, property **🡪(1)** )

**Exercise 9.3.8 Swapping two images in place**

**9.3.8 Show that two pixmaps x and y may be interchanged by performing the following three XOR combinations:**

x = x ^ y  y = x ^ y  x = x ^ y

**Solution:** The key is to keep track of the original value of **x** and **y**. Let **A** be the original value of **x** (that is, the value **x** has just before running these three statements of code). Similarly, let **B** be the original value of **y**.

We can comment each line of code to see what's happening.

// x == A, y == B

x = x ^ y // execute statement 1.

// now, x == A ^ B, y == B (x changed, y is still B)

y = x ^ y // execute statement 2.

// x == A ^ B // substituting new value of x from statement 1.

// y == (A ^ B) ^ B == A ^ (B ^ B) (by Assoc)

// == A ^ 0 (by B ^ B == 0 property)

// == A (by A ^ 0 == A property)

x = x ^ y // execute statement 3

// x == ( A ^ B ) ^ A //substituting value of x from statement 1, and value of y from statement 2

// == ( A ^ A ) ^ B (by Assoc/Commutativity)

// == 0 ^ B (by A ^ A == 0 property)

// == B (by B ^ 0 == B property)

After the second statement has executed, **y = A**. After the third statement, **x = B**.