Software Tutorial 1

This tutorial uses Python to implement a range of functions.

Demo: https://youtu.be/8tcUs7mJOgs

1 Data representation

Implement the Python code given in:

http://asecuritysite.com/calculators/datar

and complete the following table:

Binary	Decimal	ASCII	Hexadecimal	Octal
	42	*	0x2a	052
	55			
	60			
	64			

2 Bit shift

Implement the Python code given in:

http://asecuritysite.com/calculators/shift

and thus complete the following:

Value	Shift left (1)	Shift right (1)
42		
64		
23		

3 Boolean operations

Implement the Python code at:

http://asecuritysite.com/calculators/bitops2

For a Boolean equation of Z = A and B or not(C), determine the following Boolean truth table:

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

Now implement the following logic functions:

(a) Z = not (A) and not(B) or C
(b) Z = not (A and B) and C

4 Bitwise operations on integers

Implement the Python code at:

http://asecuritysite.com/calculators/bitops

Use this to complete the following table:

Value 1	Value 2	AND	OR	XOR
00110101	00110111			
10110110	11001010			
00001111	11110000			
01010101	10101010			
00110011	10101010			

5 Bit masking

Implement the Python code at:

http://asecuritysite.com/calculators/bitmask

and use this to complete the following table:

Value 1	Mask	Result
00110101	0000 0001	
00110101	0000 0010	
00110101	0000 0100	
00110101	0000 1000	
00110101	0000 01111	

6 Matrix operations

Using the Python code in the form:

```
import numpy

def dot(m, g):
    en = numpy.dot(m, g)
    return en

def multi(m, g):
    en = numpy.multiply(m, g)
    return en

g =  numpy.array([6,6,1])
h = numpy.array([[9,1,3],[6,4,2],[4,3,7]])

res=multi(g,h)
print "Multiply:"
print res

res=dot(g,h)
print "\nDot product:"
print res
```

Use this to determine the multiplication and dot product:

(a) $A = \begin{bmatrix} 7 & 4 & 2 \end{bmatrix}$ $B = \begin{bmatrix} 9 & 1 & 3 \\ 6 & 4 & 2 \\ 4 & 3 & 7 \end{bmatrix}$

(b) $A = \begin{bmatrix} 6 & 6 & 1 \end{bmatrix}$ $B = \begin{bmatrix} 9 & 1 & 3 \\ 6 & 4 & 2 \\ 4 & 3 & 7 \end{bmatrix}$

(c) The identity matrix is of the form: $I = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$.

Using some examples of the A matrices in (a) and (b), observe the output.

(d) We can also represent matrices with square brackets to represent each row. Perform a multiplication and dot product for the following:

- [1,2,3] and [2,3,4].
- [5,7,8] and [[6,2,3],[1,3,5],[5,3,8]].
- [3,4,2] and [[1,4,5],[3,4,1],[5,2,1]].
- [7,3,1] and [[2,3,0],[3,4,1],[5,2,1]].
- [[1,5,2],[1,2,1],[3,2,5]] and [[1,5,0],[3,2,1],[3,2,1]].

Check for all these questions here:

http://asecuritysite.com/comms/matrix