Qiskit Textbook Section 1.2: The Atoms of Computation

Quick Exercises:

1. Think of a number and try to write it down in binary.

Let us take 275. To write it in binary we need to find a way to express 275 as a sum of powers of 2. 256 is the greatest power of 2 less than 275. Now the remaining part of 275 is 19. We do the same with 19, and down until we are left with 1 or 0.
So,
275
= 256 + (19)
= 256 + (16 + (3))
= 256 + (16 + (2 + 1))

We have $2^8 + 2^4 + 2^1 + 2^0$, so our binary number will be the coefficients of the following expansion:

256_{10}

$= 1 \times 2^8 + 0 \times 2^7 + 0 \times 2^6 + 0 \times 2^5 + 1 \times 2^4 + 0 \times 2^3 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$

$= 100010011_2$

You can verify your solutions for other numbers that you try with the following code:

In [1]:
```
n = 275
print("Answer = " + bin(n)[2:])
```

```
Answer = 100010011
```

2. If you have n bits, how many different states can they be in?

Answer: 2^n. Each bit in can be either 0 or 1. Multiplying 2 n times for n bits gives us 2^n.