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1) Find the decimal equivalent to the following binary numbers: 10101, 100101, and 11010. Given a binary number, how would you decide whether it is an even number or an odd number?

a) 10101

16 + 4 + 1 = 21

b) 100101

$$32 + 4 + 1 = 37$$

c) 11010

16 + 8 + 2 = 26

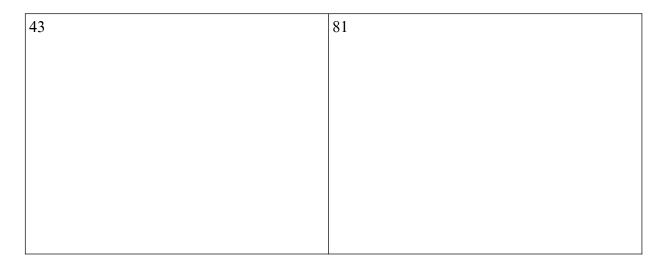
The first digit of the binary number (2<sup>0</sup>) will determine if a number is an odd or even value,

2) Find the binary representation (using both forward and backward methods) of the following decimal numbers: 28, 43, 100, and 81.

28	100

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## 3) How many binary digits are in the number $2^{128} + 1$ ?

A positive integer N has k bits when  $2^{k-1} \le N \le 2^{k-1}$  and can be written in a form of logarithm in base 2 as:

 $k = \lfloor \log_2(N) \rfloor + 1$ 

Where k, the number of bits, is equal to floor of the logarithm of base 2 of N, which is the highest power of two in the binary representation of N, and +1 takes the exponent to the next higher of two which essentially accounts for the  $2^{0 \text{ th}}$  place of your binary power.

We can apply the equation below.

 $k = \lfloor \log_2(2^{128+1}) \rfloor + 1$ k = 129 digits

Our answer is 129 digits.

4) How many binary digits are in the number  $2^{128} - 1$ ?

We can apply the name procedure as shown in (3).

$$k = \lfloor \log_2(N) \rfloor + 1$$
$$k = \lfloor \log_2(2^{128-1}) \rfloor + 1$$
$$k = 129 \text{ digits}$$

5) Translate each of the following decimal numbers into a base 3 representation: 13, 15, 21, 27, 30, and 80.

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13	15
21	27
21	27
30	80

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6) What can you say about the base 3 representation of a decimal number that when divided by 9 leaves a remainder of 7?

We can express this question into the equation below:

 $x = 9n + 7; n = 1, 2, 3, \dots$ 

Here is a range from n = 1 to n = 7.

Expression	x in base 10	x In base 2
x = 9(1) + 7	16	121
x = 9(2) + 7	25	221
x = 9(3) + 7	34	1021
x = 9(4) + 7	43	1121
x = 9(5) + 7	52	1221
x = 9(6) + 7	61	2021
x = 9(7) + 7	70	2121

The first tow digits  $(2^0 \text{ and } 2^1)$  have the same value of  $(21)_3$  while the third digit  $(2^2)$  and onwards displays a normal incrementation in base 3.

7) Find the base 5 representation of the following binary numbers: 1100102, using backward method.

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8) Convert 210223 to base 6 representation, using forward method.