Convert Base 10 (Decimal) to Base 2 (Binary)

Converting a base 10 (decimal) number to a base 2 (binary) number is easy with the **successive division method** *algorithm*. Study the following examples. The numbers are color coded to help you keep track of what is happening.

Example 1: Use successive division to convert the decimal number 56 to a binary number.

Explanation	**Show You Work**
Start with the highest binary place value (power of 2) that is *less than or equa*l to the number you want to convert (**56**). In this case it is 2^5, or **32**. Since you can divide **56** by **32**, you record a **1** and you have a remainder of **24**.	**56**/**32** = **1** remainder **24**
The next highest binary place value is 2^4, or **16**. The remainder **24** can be divided by **16**, so you record a **1** and you still have a remainder of **8**.	**24**/**16** = **1** remainder **8**
The next highest binary place value is 2^3, or **8**. The remainder **8** can be divided by **8**, so you record a **1** and you have a remainder of **0**.	**8**/**8** = **1** remainder **0**
The next highest place value is 2^2, or **4**. The remainder **0** cannot be divided by **4**, so you record a **0** and you have a remainder of **0**.	**0**/**4** = **0** remainder **0**
The next highest place value is 2^1, or **2**. The remainder **0** cannot be divided by **2**, so you record a **0** and you still have a remainder of **0**.	**0**/**2** = **0** remainder **0**
The last place value is 2^0, or **1**. The remainder **0** cannot be divided by **1**, so you record a **0**.	**0**/**1** = **0**

This *algorithm* shows that the decimal number **56** is equivalent to the binary number **111000**.

Example 2: Use successive division to convert the decimal number 701 to a binary number.

Explanation	**Show You Work**
Start with the highest binary place value (power of 2) that is *less than or equal* to the number you want to convert **701**). In this case it is 2^9, or **512**. Since you can divide **701** by **512**, you record a **1** and you have a remainder of **189**.	**701**/**512** = **1** remainder **189**
The next highest binary place value is 2^8, or **256**. The remainder **189** cannot be divided by **256**, so you record a **0** and you still have a remainder of **189**.	**189**/**256** = **0** remainder **189**
The next highest binary place value is 2^7, or **128**. The remainder **189** can be divided by **128**, so you record a **1** and you have a remainder of **61**.	**189**/**128** = **1** remainder **61**
The next highest binary place value is 2^6, or **64**. The remainder **61** cannot be divided by **64**, so you record a **0** and you still have a remainder of **61**.	**61**/**64** = **0** remainder **61**
The next highest binary place value is 2^5, or **32**. The remainder **61** can be divided by **32**, so you record a **0** and you still have a remainder of **29**.	**61**/**32** = **1** remainder **29**
The next highest binary place value is 2^4, or **16**. The remainder **29** can be divided by **16**, so you record a **1** and you still have a remainder of **13**.	**29**/**16** = **1** remainder **13**
The next highest binary place value is 2^3, or **8**. The remainder **13** can be divided by **8**, so you record a **1** and you have a remainder of **5**.	**13**/**8** = **1** remainder **5**
The next highest place value is 2^2, or **4**. The remainder **5** can be divided by **4**, so you record a **1** and you have a remainder of **1**.	**5**/**4** = **1** remainder **1**
The next highest place value is 2^1, or **2**. The remainder **1** cannot be divided by **2**, so you record a **0** and you still have a remainder of **1**.	**1**/**2** = **0** remainder **1**
The last place value is 2^0, or **1**. The remainder **1** can be divided by **1**, so you record a **1**.	**1**/**1** = **1**

This *algorithm* shows that the decimal number **701** is equivalent to the binary number **1010111101**.

Test Yourself

Test yourself with some practice problems. Check your answers with the key provided.

1. Convert 28 in base 10 to base 2.
28/16 = ___ remainder ___/8 = ___ remainder ___/4 = ___ remainder ___/2 = ___ remainder ___/1 = ___ remainder
Answer:

2. Convert 63 in base 10 to base 2.
63/32 = ___ remainder __/16 = ___ remainder ___/8 = ___ remainder ___/4 = ___ remainder ___/2 = ___ remainder ___/1 = ___ remainder
Answer:

3. Convert 100 in base 10 to base 2.
Answer:

4. Convert 130 in base 10 to base 2.
Answer:

5. Convert 212 in base 10 to base 2.
Answer:

6. Convert 247 in base 10 to base 2.
Answer:

Answers:			
	1. 11100	2. 111111	3. 1100100
	4. 10000010	5. 11010100	6. 11110111