

Quiz 1 Solution

8 February 2013

1. Using 7-bit signed (two's complement) binary numbers, what is the largest positive number? What is the smallest negative number?

In 7-bit two's complement, the column values are:

| | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|
| --- | --- | --- | --- | --- | --- | --- |
| -64 | 32 | 16 | 8 | 4 | 2 | 1 |

So the largest positive number is 0111111 = 63 and the most negative number is 1000000 = -64.

2. Convert the following 16-bit binary number into hexadecimal.

| | | | |
|---------|---------|---------|---------|
| 8 4 2 1 | 8 4 2 1 | 8 4 2 1 | 8 4 2 1 |
| ----- | ----- | ----- | ----- |
| 0 1 1 1 | 1 1 1 1 | 0 0 1 1 | 1 0 1 0 |
| 7 | F | 3 | A |

3. Add and verify the following unsigned binary numbers.

| | |
|--|--|
| 1 1 1 1 1 1 0 1 1 1 1 = 47 + 0 1 1 1 0 1 = 29 ----- 1 0 0 1 1 0 0 = 76 | 1 1 1 1 0 1 1 1 = 55 + 1 0 0 1 0 0 = 36 ----- 1 0 1 1 0 1 1 = 91 |
| 32 8 2 64 16 4 1 | 32 8 2 64 16 4 1 |

4. Suppose we need to send a text message uses just 15 distinct characters. How many bits per character are required if we're using a fixed encoding?

We need 4 bits per character, which allows 16 distinct characters to be represented.

5. Draw a binary tree that corresponds to the following variable-width encoding of four characters. The characters should appear in boxes at the leaves. Branch left on a zero, or right on a one.

T 00
 R 010
 N 011
 O 1



Figure 1:

6. Use the character encoding from the previous question to decode the following word:

0 0,1,0 1 0,1,0 1 1,0 0,1
T O R O N T O