

## SENIOR DIVISION SOLUTIONS

**1. Computer Number Systems**

$$4267_8 = 2231_{10} = 5 * 20^2 + 11 * 20 + 11$$

5 11 11 must be drawn from top to bottom as shown.

1.  $\frac{\frac{\frac{\cdot}{\cdot}}{\cdot}}{\cdot}$

**2. Computer Number Systems**

$$1_{10} = 1_2 \text{ and } 64_{10} = 1000000_2$$

Number of digits in the binary number: 1 2 3 4 5 6 7

Number with fewer 1's than 0's: 0 0 1 1 5 6 1

Total is 14.

2. 14

**3. Recursive Functions**

$$f(6,16) = f(6-2,16-3) - 1 = f(4,13) - 1 = -4 - 1 = -5$$

$$f(4,13) = f(4-2,13-3) - 1 = f(2,10) - 1 = -3 - 1 = -4$$

$$f(2,10) = f(2-2,10-3) - 1 = f(0,7) - 1 = -2 - 1 = -3$$

$$f(0,7) = f(0-2,7-3) - 1 = f(-2,4) - 1 = -1 - 1 = -2$$

$$f(-2,4) = f(-2-2,4-3) - 1 = f(-4,1) - 1 = 0 - 1 = -1$$

$$f(-4,1) = f(-4-2,1-3) - 1 = f(-6,-2) - 1 = 1 - 1 = 0$$

$$f(-6,-2) = f(-6-2,-2-3) - 1 = f(-8,-5) - 1 = 2 - 1 = 1$$

$$f(-8,-5) = f(-8-2,-5-3) - 1 = f(-10,-8) - 1 = 3 - 1 = 2$$

$$f(-10,-8) = f(-10-2,-8-3) - 1 = f(-12,-11) - 1 = 4 - 1 = 3$$

$$f(-12,-11) = f(-12-2,-11-3) - 1 = f(-14,-14) - 1 = 5 - 1 = 4$$

$$f(-14,-14) = f(-14+1,-14-2) + 2 = f(-13,-16) + 2 = 3 + 2 = 5$$

$$f(-13,-16) = -13 - (-16) = -13 + 16 = 3$$

3. -5

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## 4. Recursive Functions

4. 5

Feet up: 128      Total: 128

Feet down:128      Total: 256

**BOUNCE: 1**

Feet up: 64      Total: 320

Feet down:64      Total: 384

**BOUNCE: 2**

Feet up: 32      Total: 416

Feet down:32      Total: 448

**BOUNCE: 3**

Feet up: 16      Total: 464

Feet down:16      Total: 480

**BOUNCE: 4**

Feet up: 8      Total: 488

Feet down:8      Total: 496

**BOUNCE: 5**

Feet up: 4      Total: 500

Therefore it takes 5 bounces to travel 500 feet.

## 5. What Does This Program Do?

5. 1

<b>a</b>	<b>b</b>	<b>c</b>	<b>d</b>	<b>e</b>	<b>f</b>
100	20	5	4	4	
100	20	5	4	4	2
100	20	5	5	4	2
50	20	5	5	4	2
30	20	5	5	4	2
30	1	5	5	4	2

$$\begin{aligned}
 g &= f \uparrow c / e - e * f + b \uparrow (a + 2 * d) * c * e / (d * e) \\
 &= 2 \uparrow 5 / 4 - 4 * 2 + 1 \uparrow (30 + 2 * 5) * 5 * 4 / (5 * 4) \\
 &= 32 / 4 - 4 * 2 + 1 \uparrow 40 * 5 * 4 / (5 * 4) \\
 &= 32 / 4 - 8 + 1 * 5 * 4 / 20 \\
 &= 8 - 8 + 20 / 20 \\
 &= 8 - 8 + 1 \\
 &= 1
 \end{aligned}$$