

## JUNIOR DIVISION SOLUTIONS

**1. Computer Number Systems**

$$2018 = 3 * 8^3 + 7 * 8^2 + 4 * 8^1 + 2 * 8^0 = 3742_8$$

**1.**  $3742_8$  or 3742**2. Computer Number Systems**

$$1_{10} = 1_2 \text{ and } 32_{10} = 100000_2$$

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

Number with same number of 1's as 0's:    0    1    0    3    0

Total is 4.

**2.** 4**3. Recursive Functions**

$$f(18) = f(18-5)+1 = f(13)+1 = 3+1 = 4$$

$$f(13) = f(13-5)+1 = f(8)+1 = 2+1 = 3$$

$$f(8) = f(8-5)+1 = f(3)+1 = 1+1 = 2$$

$$f(3) = f(3+3)-2 = f(6)-2 = 3-2 = 1$$

$$f(6) = f(6-5)+1 = f(1)+1 = 2+1 = 3$$

$$f(1) = f(1+3)-2 = f(4)-2 = 4-2 = 2$$

$$f(4) = f(4+3)-2 = f(7)-2 = 6-2 = 4$$

$$f(7) = f(7-5)+1 = f(2)+1 = 5+1 = 6$$

$$f(2) = f(2+3)-2 = f(5)-2 = 7-2 = 5$$

$$f(5) = 7$$

**3.** 4**4. Recursive Functions**

$$f(24) = [24/2]+1 = [12]+1 = 12+1 = 13$$

$$f(13) = [13/3]-2 = [4.333...] - 2 = 4-2 = 2$$

$$f(2) = [2/2]+1 = [1]+1 = 2$$

$$\text{So } f(f(f(f(24)))) = f(f(f(13)))$$

$$= f(f(2))$$

$$= f(2) = 2$$

**4.** 2

**JUNIOR DIVISION SOLUTIONS****5. What Does This Program Do? - Branching****5. 8**

<b>a</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>f</b>
2	1	0	3	4	
2	1	0	3	4	10
2	1	0	3	4	2
2	3	0	3	4	2
2	3	0	4	4	2
2	4	0	4	4	2
2	4	0	0	4	2

$$\begin{aligned}2 * a + b * (c - d) + e / 2 * f &= 2 * 2 + 4 * (0 - 0) + 4 / 2 * 2 \\&= 2 * 2 + 4 * 0 + 4 / 2 * 2 \\&= 4 + 0 + 4 \\&= 8\end{aligned}$$