Number Systems - webinar 1/7/20

$$(11)_{10} = (\underset{8}{1}\,\underset{1}{3})_8 = (1011)_2$$

decimal	base 2
1	1
2	10
3	11
4	100
5	101
6	110
7	111
8	1000
9	1001
10	1010
11	1011

$$(900)_{10} = (1110000100)_2$$

look for greatest power of 2

* too big!

$\boxed{\text{Method \#1}}$ → left to right

...											
0	0	1	1	1	0	0	0	0	1	0	0
1024	512	256	128	64	32	16	8	4	2	1	

$$900 - 512 = 388 - 256 = 132 - 128 = \boxed{4}$$

Method #2

"successive division

$(900)_2 = (1110000100)_2$

easier!

$900 \div 2 =$	450	R0
$450 \div 2 =$	225	R0
$225 \div 2 =$	112	R1
$112 \div 2 =$	56	R0
$56 \div 2 =$	28	R0
$28 \div 2 =$	14	R0
$14 \div 2 =$	7	R0
$7 \div 2 =$	3	R1
$3 \div 2 =$	1	R1
$1 \div 2 =$	0	R1

"method is logically justifiable"

This method can be extended to other number systems

$(900)_{10} = (1604)_8$

$900 \div 8 = 112$ R4

$112 \div 8 = 14$ R0

$14 \div 8 = 1$ R6

$1 \div 8 = 0$ R1

"in the order you expose them, right to left."

$(708)_{10} = \cancel{(2\ 12\ 4)_{16}}$

$708 \div 16 = 44$ R4

$44 \div 16 = 2$ R12

$2 \div 16 = 0$ R2

need $\overset{10}{a}, \overset{11}{b}, \overset{12}{c}, \overset{13}{d}, \overset{14}{e}, \overset{15}{f}, g$

since we can only use single characters

$(708)_{10} = (2c4)_{16}$

$(52)_{10} = (110100)_2$

$(-52)_{10} = (-110100)_2$

$(\sqrt{52})_{10} = (\sqrt{110100})_2$

$(52.5)_{10} = (110100.1)_2$

$\uparrow \frac{1}{2}$

321.256

$10^2 \; 10^1 \; 10^0 \; 10^{-1} \; 10^{-2} \; 10^{-3}$

Two's Complement

$(52)_{10} = (00110100)_{8\text{-bit 2's comp}}$

$(-52)_{10} = (11001100)_{8\text{-bit 2's comp}}$

		1	1	1	1				
	0	0	1	1	0	1	0	0	$\boxed{52}$ in 8-bit 2's comp
+	1	1	0	0	1	1	0	0	$\boxed{-52}$ in 8-bit 2's comp
1	0	0	0	0	0	0	0	0	$\leftarrow 2^8$

$(11001100)_{\substack{8\text{-bit} \\ 2\text{'s comp}}} \neq (11001100)_2$

" different systems are used in the computer "

* 8 -bits $\rightarrow 2^8 = 256$

↳ limited range $(-256, 256)$

-256 would be out of range for 8-bit