Program 6 Advice

(1) Start NOW!

(2) Create your structs + in particular your heap + test it separately and make sure it works

(3) Carefully write out on paper all the decisions that have to be made so you understand the flow of logic.

Today's Topic

Base Conversion

Base 10 - 10 symbols

$4736 = 4\times10^3 + 7\times10^2 + 3\times10^1 + 6\times10^0$

What if we used b symbols?

$b<10 \Rightarrow 0, 1, 2, 3, \ldots b-1$

$b=5$

0, 1, 2, 3, 4, 10, 11, 12, 13, 14, 20, ...

$2341_5 \Rightarrow$ $\underline{10}$ → subscript is the base of a #.

$2\times5^3 + 3\times5^2 + 4\times5^1 + 1\times5^0$

$= 250 + 75 + 20 + 1$

$= \boxed{346_{10}}$

Computer uses base 2 (binary)

$1011 = 1\times2^3 + 0\times2^2 + 1\times2^1 + 1\times2^0 = 11$

if $b>10$, conventions use 'a', 'b', 'c', ...

$b=16$ Hexadecimal 0, 1, 2, ..., 'a', 'b', ... 'f'.

$3CD_{16} = \_\_\_\_\_{}_{10}$

$3 \times 16^2 + 12 \times 16^1 + 13 \times 16^0$

$= 768 + 192 + 13$

$$\begin{array}{r} 192 \\ +\ 13 \\ \hline 973_{10} \end{array}$$

A = 10
B = 11
C = 12
D = 13
E = 14
F = 15

~~Ofte~~ Base 10 $\Rightarrow$ Base B

346_{10} $\Rightarrow$ $(\ldots + 5^2 d_2 + 5 d_1 + d_0)$

$346_{10} \Rightarrow \_\_\_\__5$

What is this expression mod 5?

$= d_0$

all other terms have a factor of 5.

What happens when I divide by 5? (int)

$\ldots + 5^2 d_3 + 5 d_2 + d_1$

the number shifted over by one. (number w/ the last digit chopped off)

$$\begin{array}{r|l} 5 & 346 \\ 5 & 69 \quad R1 = d_0 \\ 5 & 13 \quad R4 = d_1 \\ 5 & 2 \quad R3 = d_2 \\ & 0 \quad R2 = d_3 \end{array}$$

$\Rightarrow 2341_5$

Base Conversion Short Cut

$3725_8 = \_\_\_\_\_ _{16}$

Usual $\Rightarrow$ 8 $\Rightarrow$ (10) $\Rightarrow$ (16)

$8 = 2^3$, $16 = 2^4$ 8 $\Rightarrow$ (2) $\Rightarrow$ 16

011 111 010 101

3 7 2 5

easy 8 $\Rightarrow$ 2 each octal digit is 3 bits. write down

0111 | 1101 | 0101

7 D 5 $_{16}$

$\Rightarrow$ regroup from right into groups of 4 since $2^4 = 16$ convert each group of 4 bits to HEX

$2931_{10} \Rightarrow$ base 6

6 | 2931

6 | 488 R3

6 | 81 R2

6 | 13 R3

6 | 2 R1

0 R2

21323_6

$23412_5 \Rightarrow$ base 7

$23412_5 \Rightarrow$ base 10

$2\times5^4 + 3\times5^3 + 4\times5^2 + 1\times5^1 + 2\times5^0 =$

$1250 + 375 + 100 + 5 + 2$

1250
375
1625
$+107$
1732

$= 1732_{10} = \boxed{5023_7}$

$7 \mid 1732$
$7 \mid 247$ R3
$7 \mid 35$ R2
$7 \mid 5$ R0
0 R5