modular arithmetic
congruences
> hash tables
hashing
bases used in DS

? Chinese Theorem

Ch 4.2 ~~7~~, ~~19~~, 27, 37, 43

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

⑦

(1) $(80\overset{14}{E})_{16}$

$\overset{8\,4\,2\,1}{1000}$ 0000 1110

(2) $(ABBA)_{16}$

1010 1011 1011 1010

(3) $(135AB)_{16}$

0001 0011 0101 1010 1011

(4) $(DEFACED)_{16}$

1101 1110 1111 1010 1100 1110 1101

⑲ ⌈each octal integer corresponds to a block of 3 binary digits:

Ex: $(12345)_{10}$

$12345 = 8 \cdot 1543 + 1$

$1543 = 8 \cdot 192 + 7$

$192 = 8 \cdot 24 + 0$

$24 = 8 \cdot 3 + 0$

$3 = 8 \cdot 0 + 3$

↑

$(3007)_8$

$(3007)_8$

~~[illegible]~~

011 000 000 111

421

Each hexadecimal corresponds to a block of 4 binary digits

0110 0000 0111

8421

$(607)_{16}$

(27) 3^{2003} mod 99 (Fast Exponentiation) alg. 5

initially sets x = 1 and power = 3 mod 99 = 3

repeatedly square the base

(1) $2003 = 2^{10} + 2^9 + 2^8 + 2^7 + 2^6 + 2^5 + 2^1 + 2^0$

(2) calculate powers of 3 modulo 99, $\Rightarrow 3^{2^k} \bmod 99$

$3^1 \bmod 99 = 3$

$3^2 \bmod 99 = 3^2 = 9$

$3^4 \bmod 99 = 9^2 = 81$

$3^8 \bmod 99 = 81^2 = 6561 \bmod 99 = 27$

$3^{16} \bmod 99 = 27^2 = 729 \bmod 99 = 36$

$3^{32} \bmod 99 = 36^2 = 1296 \bmod 99 = 6$

$3^{64} \bmod 99 = 6^2 = 36$

$3^{128} \bmod 99 = 36^2 = 6$

$3^{256} \bmod 99 = 6^2 = 36$

$3^{512} \bmod 99 = 36^2 = 6$

$3^{1024} \bmod 99 = 6^2 = 36$

? Addition of integers

㊲ (1) add the numbers directly
(2) Check for carry out
(3) Check the result
(4) Determine Overflow
(5) Interpret the Result

A → 5 → $\overset{8421}{0101}$
B → 3 → 0011

$$\begin{array}{r} + \; 0101 \\ 0011 \\ \hline 1000 \end{array} \rightarrow -7 \text{ (in a 4 bit ones' complement system)}$$

$3^{11} \Rightarrow 11 = (1011)_2 \Rightarrow 3^{11} = 3^8 3^2 3^1$

$3^2 = 9$

$3^4 = 9^2 = 81$

$3^8 = (81)^2 = 6561$

$3^{11} = 3^8 \cdot 3^2 \cdot 3^1 = 6561 \cdot 9 \cdot 3 = 177,147$

⑬ for 2's complement expantions