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(0)  Summarize Chapter I :
        Chapter I of the textbook takes readers back to
the most basic foundation of mathematics. The author
discusses the first concept of the number system, which
dates back to the Old Stone Age. During the times
before this, the general population had minimal understanding
of numerical values. Eventually, when hunting and gathering
transformed into agriculture and production. This was the
start of a whole new era of development, including
crafts such as pottery, carpentry, and weaving. Numerical
terms for new developments only slowly came into use.
First came qualitative conceptions, which slowly became
quantitative distinctions. Different bases (such as base 5, and
base 10) were invented, and then arithmetic operations
within these bases. Then, civilization progressed to measure
the size and contents of various objects, and these measurements
eventually became more complicated. This was just the
beginning of mathematics. As we can see, it grew quickly
and is constantly used in today's world.

① Express $100_{10}$ in

a) base two:
$$1(2^6) + 1(2^5) + 0(2^4) + 0(2^3) + 1(2^2) + 0(2^1) + 0(2^0)$$
$$= 1100100_2$$

b) base three:
$$2(3^4) + 0(3^3) + 2(3^2) + 0(3^1) + 1(3^0)$$
$$= 10201_3$$

c) base four:
$$1(4^3) + 2(4^2) + 1(4^1) + 0(4^0)$$
$$= 1210_4$$

d) base five:
$$4(5^2) + 0(5^1) + 0(5^0)$$
$$= 400_5$$

e) base six:
$$2(6^2) + 4(6^1) + 4(6^0)$$
$$= 244_6$$

f) base seven:
$$2(7^2) + 0(7^1) + 2(7^0)$$
$$= 202_7$$

g) base eight:
$$1(8^2) + 4(8^1) + 4(8^0)$$
$$= 144_8$$

h) base nine:
$$1(9^2) + 2(9^1) + 1(9^0)$$
$$= 121_9$$

i) base ten:
$$1(10^2) + 0(10^1) + 0(10^0)$$
$$= 100_{10}$$

j) base eleven
$$9(11^1) + 1(11^0)$$
$$91_{11}$$

k) base twelve
$$8(12^1) + 4(12^0)$$
$$= 84_{12}$$

② $101 = 100 + 1$ , $= 1(10^2) + 0(10^1) + 1(10^0)$
$$= (1, 0, 1)$$

$97 = 100 - 3 = 1(10^2) - 1(10^1) + 7(10^0)$
$$= (1, -1, 7)$$

$101 \cdot 97 =$

$$
\begin{array}{rrr}
 & 1 & 0 & 1 \\
\times & 1 & -1 & 7 \\
\hline
 & 7 & 0 & 7 \\
-1 & 0 & -1 \\
1 & 0 & 1 \\
\hline
1 & -1 & 8 & -1 & 7
\end{array}
$$

$(1, -1, 8, -1, 7)$
$$= (9, 8, -1, 7)$$
$$= (9, 7, 9, 7)$$
$$= \boxed{9797}$$

③ $26_{10} = 2(3^2) + 2(3^1) + 2(3^0)$
$$= 222_3$$

$80_{10} = 2(3^3) + 2(3^2) + 2(3^1) + 2(3^0)$
$$= 2222_3$$

$$
\begin{array}{r}
2\,2\,2\,2 \\
\times \quad 2\,2\,2 \\
\hline
1\,2\,2\,2\,1 \\
1\,2\,2\,2\,1 \\
1\,2\,2\,2\,1 \\
\hline
2\,2\,1\,2\,0\,0\,1
\end{array}
$$

$(2, 2, 1, 2, 0, 0, 1)$
$$= \boxed{2212001_3}$$

④
| | |
|---|---|
| 1 = 1 | |
| 2 = 2 | |
| 3 = 10 | |
| 4 = 11 | |
| 5 = 12 | |
| 6 = 20 | |
| 7 = 21 | |
| 8 = 22 | |
| 9 = 100 | |
| 10 = 101 | |
| 11 = 102 | |
| 12 = 110 | |
| 13 = 111 | |
| 14 = 112 | |
| 15 = 120 | |
| 16 = 121 | |
| 17 = 122 | |
| 18 = 200 | |
| 19 = 201 | |
| 20 = 202 | |
| 21 = 210 | |
| 22 = 211 | |
| 23 = 212 | |
| 24 = 220 | |
| 25 = 221 | |
| 26 = 222 | |

1   4   7
10  13  16
19  22  25

2   5   8
11  14  17
20  23  26

3   4   5
12  13  14
21  22  23

6   7   8
15  16  17
24  25  26

9   10  11.
12  13  14
15  16  17

18  19  20
21  22  23
24  25  26