

Homework 0

1. Express 100_{10} :

$$a) 100_{10} = 1 \cdot 2^6 + 36$$

$$1 \cdot 2^6 + 1 \cdot 2^5 + 4$$

$$1 \cdot 2^6 + 1 \cdot 2^5 + 0 \cdot 2^4 + 0 \cdot 2^3 + 1 \cdot 2^2 + 0 \cdot 2^1 + 0 \cdot 2^0$$

$$= 1100100_2$$

$$b) 100_{10} = 1 \cdot 3^4 + 19$$

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

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

$$= 10201_3$$

$$c) 100_{10} = 1 \cdot 4^3 + 36$$

$$1 \cdot 4^3 + 2 \cdot 4^2 + 4$$

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

$$= 1210_4$$

$$d) 100_{10} = 4 \cdot 25 = 4 \cdot 5^2 + 0 \cdot 5^1 + 0 \cdot 5^0$$

$$= 400_5$$

$$e) 100_{10} = 2 \cdot 6^2 + 28$$

$$2 \cdot 6^2 + 4 \cdot 6^1 + 4 \cdot 6^0$$

$$= 244_6$$

$$f) 100_{10} = 2 \cdot 7^2 + 2$$

$$2 \cdot 7^2 + 0 \cdot 7^1 + 2 \cdot 7^0$$

$$= 202_7$$

$$g) 100_{10} = 1 \cdot 8^2 + 4 \cdot 8^1 + 4$$

$$1 \cdot 8^2 + 4 \cdot 8^1 + 4 \cdot 8^0$$

$$= 144_8$$

$$h) 100_{10} = 1 \cdot 9^2 + 19$$

$$1 \cdot 9^2 + 2 \cdot 9^1 + 1 \cdot 9^0$$

$$= 121_9$$

$$i) 100_{10} = 1 \cdot 10^2 + 0 \cdot 10^1 + 0 \cdot 10^0 \\ = 100_{10}$$

$$j) 100_{10} = 9 \cdot 11^1 + 1 \cdot 11^0 \\ = 91_{11}$$

$$k) 100_{10} = 8 \cdot 12^1 + 4 \cdot 12^0 \\ = 84_{12}$$

$$2. \quad 101 = 1 \cdot 10^2 + 0 \cdot 10^1 + 1 \cdot 10^0 = (1, 0, 1)$$

$$97 = 1 \cdot 10^2 + 0 \cdot 10^1 - 3 \cdot 10^0 = (1, 0, -3)$$

$$\text{Then } 101 \times 97: \begin{array}{r} 1 \ 0 \ 1 \\ \times \quad 1 \ 0 \ -3 \\ \hline -3 \ 0 \ -3 \end{array}$$

$$\begin{array}{r} 1 \ 0 \ 1 \\ \hline \end{array}$$

$$1 \ 0 \ -2 \ 0 \ -3 = 1 \cdot 10^4 + 0 \cdot 10^3 - 2 \cdot 10^2 + 0 \cdot 10^1 - 3 \cdot 10^0$$

$$= 10000 - 2000 - 3 = 9797$$

$$\text{So } 101 \times 97 = (1, 0, 1) \times (1, 0, -3) = (1, 0, -2, 0, -3) = 9797$$

$$3. \quad 26_{10} = 1 \cdot 3^3 + 0 \cdot 3^2 + 0 \cdot 3^1 - 1 \cdot 3^0 = (1, 0, 0, -1)_3$$

$$80_{10} = 1 \cdot 3^4 + 0 \cdot 3^3 + 0 \cdot 3^2 + 0 \cdot 3^1 - 1 \cdot 3^0 = (1, 0, 0, 0, -1)_3$$

$$\text{Then } 26_{10} \times 80_{10}:$$

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

$$\begin{array}{r} 1 \ 0 \ 0 \ 0 \ -1 \\ \hline \end{array}$$

$$-1 \ 0 \ 0 \ 1$$

$$\begin{array}{r} 1 \ 0 \ 0 \ -1 \\ \hline \end{array}$$

$$(1 \ 0 \ 0 \ -1 \ -1 \ 0 \ 0 \ 1)_3$$

4. Convert numbers 1-26 to base 3

$$1_{10} = 001_3$$

$$9_{10} = 100$$

$$18 = 200$$

$$2_{10} = 002_3$$

$$10_{10} = 101$$

$$19 = 201$$

$$3_{10} = 010_3$$

$$11 = 102$$

$$20 = 202$$

$$4_{10} = 011_3$$

$$12 = 110$$

$$21 = 210$$

$$5_{10} = 012_3$$

$$13 = 111$$

$$22 = 211$$

$$6_{10} = 020_3$$

$$14 = 112$$

$$23 = 212$$

$$7_{10} = 021_3$$

$$15 = 120$$

$$24 = 220$$

$$8_{10} = 022_3$$

$$16 = 121$$

$$25 = 221$$

$$17 = 122$$

$$26 = 222$$

Box 1: $(_ _ 1)_3$

1 4 7

10 13 16

19 22 25

Box 2: $(_ _ 2)_3$

2 5 8

11 14 17

20 23 26

Box 3: $(- 1 _)_3$

3 4 5

12 13 14

21 22 23

Box 4: $(- 2 _)_3$

6 7 8

15 16 17

24 25 26

Box 5: $(1 _ _)_3$

9 10 11

12 13 14

15 16 17

Box 6: $(2 _ _)_3$

18 19 20

21 22 23

24 25 26