

Sarah Magno
Dr. Z, History of Math
9/5/21

Homework for Lecture 0

① (a.) $2^0=1, 2^1=2, 2^2=4, 2^3=8, 2^4=16, 2^5=32, 2^6=64$

$$100 = 64 + 32 + 4 = \frac{1}{2^6} \frac{1}{2^5} \frac{0}{2^4} \frac{0}{2^3} \frac{1}{2^2} \frac{0}{2^1} \frac{0}{2^0}$$

$$100 = \boxed{1100100_2}$$

(b.) $3^0=1, 3^1=3, 3^2=9, 3^3=27, 3^4=81$

$$100 = 81 + 2(9) + 1 = \frac{1}{3^4} \frac{0}{3^3} \frac{2}{3^2} \frac{0}{3^1} \frac{1}{3^0}$$

$$100 = \boxed{10201_3}$$

(c.) $4^0=1, 4^1=4, 4^2=16, 4^3=64$

$$100 = 64 + 2(16) + 4 = \frac{1}{4^3} \frac{2}{4^2} \frac{1}{4^1} \frac{0}{4^0}$$

$$100 = \boxed{1210_4}$$

(d.) $5^0=1, 5^1=5, 5^2=25$

$$100 = 4(25) = \frac{4}{5^2} \frac{0}{5^1} \frac{0}{5^0}$$

$$100 = \boxed{400_5}$$

① (e.) $6^0 = 1, 6^1 = 6, 6^2 = 36$

$$100 = 2(36) + 4(6) + 4 = \frac{2}{6^2} \frac{4}{6^1} \frac{4}{6^0}$$

$$100 = \boxed{244_6}$$

(f.) $7^0 = 1, 7^1 = 7, 7^2 = 49$

$$100 = 2(49) + 2 = \frac{2}{7^2} \frac{0}{7^1} \frac{2}{7^0}$$

$$100 = \boxed{202_7}$$

(g.) $8^0 = 1, 8^1 = 8, 8^2 = 64$

$$100 = 64 + 4(8) + 4 = \frac{1}{8^2} \frac{4}{8^1} \frac{4}{8^0}$$

$$100 = \boxed{144_8}$$

(h.) $9^0 = 1, 9^1 = 9, 9^2 = 81$

$$100 = 81 + 2(9) + 1 = \frac{1}{9^2} \frac{2}{9^1} \frac{1}{9^0}$$

$$100 = \boxed{121_9}$$

(i.) $100 = \boxed{100_{10}}$

(j.) $11^0 = 1, 11^1 = 11$

$$100 = 11(9) + 1 = \frac{9}{11^1} \frac{1}{11^0}$$

$$100 = \boxed{91_{11}}$$

(k.) $12^0 = 1, 12^1 = 12$

$$100 = 12(8) + 4 = \frac{8}{12^1} \frac{4}{12^0}$$

$$100 = \boxed{84_{12}}$$

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$$\textcircled{2} \quad 101 = (1, 0, 1)$$

$$97 = (1, 0, -3)$$

$$\begin{array}{r} 101 \\ 10-3 \\ \hline -30-3 \\ 1010 \\ \hline 10-20-3 \end{array}$$

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$$(1, 0, -2, 0, -3) = (9, 8, 0, -3) = (9, 7, 9, 7)$$

$$101 \times 97 = \boxed{9797}$$

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$$\textcircled{3} \quad 3^0 = 1, 3^1 = 3, 3^2 = 9, 3^3 = 27$$

$$26 = 2(9) + 2(3) + 2(1) = \frac{2}{3^2} \frac{2}{3^1} \frac{2}{3^0}$$

$$26 = 222_3$$

$$80 = 2(27) + 2(9) + 2(3) + 2(1) = \frac{2}{3^3} \frac{2}{3^2} \frac{2}{3^1} \frac{2}{3^0}$$

$$80 = 2222_3$$

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$$\begin{array}{r} 111 \\ 2222 \\ 222 \\ \hline 12221 \end{array}$$

$$\begin{array}{r} 12221 \\ 12221 \\ \hline 1356531 \end{array}$$

$$\begin{array}{r} 1356531 \\ \hline 2212001 \end{array}$$

$$3 = (1, 0)$$

$$4 = (1, 1)$$

$$5 = (1, 2)$$

$$6 = (2, 0)$$

$$7 = (2, 1)$$

$$8 = (2, 2)$$

$$26_{10} \times 80_{10} = \boxed{2212001_3}$$

$$(4) 3^0=1, 3^1=3, 3^2=9$$

$$1 = 1_3, 2 = 2_3$$

$$3 = 1(3) = \frac{1}{3^1} \frac{0}{3^0} = 10_3$$

$$4 = 1(3) + 1 = \frac{1}{3^1} \frac{1}{3^0} = 11_3$$

$$5 = 1(3) + 2 = \frac{1}{3^1} \frac{2}{3^0} = 12_3$$

$$6 = 2(3) = \frac{2}{3^1} \frac{0}{3^0} = 20_3$$

$$7 = 2(3) + 1 = \frac{2}{3^1} \frac{1}{3^0} = 21_3$$

$$8 = 2(3) + 2 = \frac{2}{3^1} \frac{2}{3^0} = 22_3$$

$$9 = 1(9) = \frac{1}{3^2} \frac{0}{3^1} \frac{0}{3^0} = 100_3$$

$$10 = 1(9) + 1 = \frac{1}{3^2} \frac{0}{3^1} \frac{1}{3^0} = 101_3$$

$$11 = 1(9) + 2 = \frac{1}{3^2} \frac{0}{3^1} \frac{2}{3^0} = 102_3$$

$$12 = 1(9) + 1(3) = \frac{1}{3^2} \frac{1}{3^1} \frac{0}{3^0} = 110_3$$

$$13 = 1(9) + 1(3) + 1(1) = \frac{1}{3^2} \frac{1}{3^1} \frac{1}{3^0} = 111_3$$

$$14 = 1(9) + 1(3) + 2(1) = \frac{1}{3^2} \frac{1}{3^1} \frac{2}{3^0} = 112_3$$

$$15 = 1(9) + 2(3) = \frac{1}{3^2} \frac{2}{3^1} \frac{0}{3^0} = 120_3$$

$$16 = 1(9) + 2(3) + 1(1) = \frac{1}{3^2} \frac{2}{3^1} \frac{1}{3^0} = 121_3$$

$$17 = 1(9) + 2(3) + 2(1) = \frac{1}{3^2} \frac{2}{3^1} \frac{2}{3^0} = 122_3$$

$$18 = 2(9) = \frac{2}{3^2} \frac{0}{3^1} \frac{0}{3^0} = 200_3$$

$$19 = 2(9) + 1(1) = \frac{2}{3^2} \frac{0}{3^1} \frac{1}{3^0} = 201_3$$

$$20 = 2(9) + 2(1) = \frac{2}{3^2} \frac{0}{3^1} \frac{2}{3^0} = 202_3$$

$$21 = 2(9) + 1(3) = \frac{2}{3^2} \frac{1}{3^1} \frac{0}{3^0} = 210_3$$

$$22 = 2(9) + 1(3) + 1(1) = \frac{2}{3^2} \frac{1}{3^1} \frac{1}{3^0} = 211_3$$

$$23 = 2(9) + 1(3) + 2(1) = \frac{2}{3^2} \frac{1}{3^1} \frac{2}{3^0} = 212_3$$

$$24 = 2(9) + 2(3) = \frac{2}{3^2} \frac{2}{3^1} \frac{0}{3^0} = 220_3$$

$$25 = 2(9) + 2(3) + 1(1) = \frac{2}{3^2} \frac{2}{3^1} \frac{1}{3^0} = 221_3$$

$$26 = 2(9) + 2(3) + 2(1) = \frac{2}{3^2} \frac{2}{3^1} \frac{2}{3^0} = 222_3$$

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(4)

1 4 7
10 13 16
19 22 25

2 5 8
11 14 17
20 23 26

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3 4 5
12 13 14
21 22 23

6 7 8
15 16 17
24 25 26

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9 10 11
12 13 14
15 16 17

18 19 20
21 22 23
24 25 26

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