

Series: Mathematics - from zero to engineer (13).

Using octal numbers as an intermediate step.

a) convert to the octal system

$$348,654_{10} = 534,517_8$$

remainder

$$\begin{array}{r} 348 : 8 \\ 43 : 8 \\ 5 : 8 \\ 0 \end{array}$$

$$\begin{array}{c} 4 \\ \uparrow 3 \\ 5 \end{array}$$

$$\begin{array}{r} 0,654 : 8 \\ 5,232 : 8 \\ 1,856 : 8 \\ 6,848 : 8 \\ 6,784 \end{array}$$

b) write the binary equivalent of each digit in groups of three binary digits.

$$348,654_{10} = 534,517_8 = 101011100,101001111_2 =$$

$$\begin{array}{cccccc} 101 & 011 & 100 & 101 & 001 & 111 \\ 5 & 3 & 4 & 5 & 1 & 7 \end{array}$$

(see "Place Values" in Part 10.)

c) group the binary digits into groups of four, moving away from the decimal point in both directions.

$$0001 \ 0101 \ 1100, 1010 \ 0111 \ 1000 \rightarrow \text{(add zeros so that there are four digits).}$$

(add zeros so that there are four digits).

d) write the hexadecimal equivalent of each group of four binary digits.

$$348,654_{10} = 534,517_8 = 101011100,101001111_2 = 15C, A78_{16}$$

$$\begin{array}{cccccc} 0001 & 0101 & 1100 & 1010 & 0111 & 1000 \\ 1 & 5 & 12 & 10 & 7 & 8 \\ & & C & A & & \end{array}$$

Convert to octal, binary and hexadecimal form.

$$428,371_{10} = 654,276_8$$

$$\begin{array}{r} 428 : 8 \\ 53 : 8 \\ 6 : 8 \\ 0 \end{array}$$

$$\begin{array}{c} 4 \\ \uparrow 5 \\ 6 \end{array}$$

remainder

$$\begin{array}{r} 0,371 : 8 \\ 2,968 : 8 \\ 7,744 : 8 \\ 5,952 : 8 \\ 7,616 \end{array}$$

110 101 100, 010 111 110
6 5 4, 2 7 6

$$428, 371_{10} = 654, 276_8 = 110101100, 010111110_2 = 1AC, 5F_{16}$$

0001 1010 1100, 0101 1111 0000
1 10 12 5 15 0
A C F

Convert to octal, binary and hexadecimal form.

$$163, 245_{10} = 243, 175_8 = 010100011, 001111101_2 = 113, 3E8_{16}$$

remainder

163 : 8
20 : 8
2 : 8
0

3
4
2

↑

↓

0,245 : 8
1,96 : 8
7,68 : 8
5,44 : 8

010 100 011, 001 111 101
2 4 3, 1 7 5

0000 1010 0011, 0011 1110 1000
0 10 3 3 14 8
A E

Convert to binary, octal and decimal form - the reverse method.

$$a) 4B2, 1A6_{16} = 010010110010, 000110100110_2 = 2262, 0646_8 = 1202, 103_{10}$$

$$A=10, B=11.$$

0100 1011 0010, 0001 1010 0110
4 11 2, 1 10 6

010 010 110 010, 000 110 100 110
2 2 6 2, 0 6 4 6

$$2262, 0646_8 = 1202, 103_{10}$$

$$\begin{array}{r} 2 \\ \cdot 8 \\ \hline 16 \end{array} \quad \begin{array}{r} 2 \\ + 16 \\ \hline 18 \\ \cdot 8 \\ \hline 144 \end{array} \quad \begin{array}{r} 6 \\ + 144 \\ \hline 150 \\ \cdot 8 \\ \hline 1200 \end{array} \quad \begin{array}{r} 2 \\ + 1200 \\ \hline 1202 \end{array} \quad \begin{array}{r} 0 \\ \cdot 8 \\ \hline 0 \end{array} \quad \begin{array}{r} 6 \\ + 0 \\ \hline 6 \\ \cdot 8 \\ \hline 48 \end{array} \quad \begin{array}{r} 4 \\ + 48 \\ \hline 52 \\ \cdot 8 \\ \hline 416 \end{array} \quad \begin{array}{r} 6 \\ + 416 \\ \hline 422 \end{array}$$

$$422 \cdot 8^{-4} = 422 \cdot \frac{1}{4096} = \frac{422}{4096} = 0,103$$

$$b) 2E3,4D_{16} = 001011100011,01001101_2 = 1343,232_8 = 739,301_{10}$$

$$D=13, E=14$$

$$\begin{array}{cccccc} 0010 & 1110 & 0011 & , & 0100 & 1101 \\ 2 & 14 & 3 & & 4 & 13 \end{array}$$

$$\begin{array}{cccccc} 001 & 011 & 100 & 011 & , & 010 & 011 & 010 \\ 1 & 3 & 4 & 3 & & 2 & 3 & 2 \end{array}$$

$$1343,232_8 = 739,301_{10}$$

$$\begin{array}{r} 1 \\ \cdot 8 \\ \hline 8 \end{array} \quad \begin{array}{r} 3 \\ + 8 \\ \hline 11 \\ \cdot 8 \\ \hline 88 \end{array} \quad \begin{array}{r} 4 \\ + 88 \\ \hline 92 \\ \cdot 8 \\ \hline 736 \end{array} \quad \begin{array}{r} 3 \\ + 736 \\ \hline 739 \end{array} \quad , \quad \begin{array}{r} 2 \\ \cdot 8 \\ \hline 16 \end{array} \quad \begin{array}{r} 3 \\ + 16 \\ \hline 19 \\ \cdot 8 \\ \hline 152 \end{array} \quad \begin{array}{r} 2 \\ + 152 \\ \hline 154 \end{array}$$

$$154 \cdot 8^{-3} = 154 \cdot \frac{1}{512} = \frac{154}{512} = 0,301$$