

1. (a) 54441

2. (a) 1111

3. 9999

4. 1000 1000 1000

5. (a) 1111 = 15

6. (a) 1111

7. 1111 1000 1000 1000

8. 44 = 1111 1000

9. 2.2

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

$= 2^4 + 2^3 + 2^2 + 2^1 + 2^0$

$= 2^4 + 2^3 + 2^2 + 2^1 + 2^0$

$2^4 + 2^3 + 2^2 + 2^1 + 2^0 = 15$

$= 25$

$= 11.11111111$

$[11111111]$

10. (a)

8 = 1000

15 = 1111

4 = 100

12 = 1100

10 = 1010

14 = 1110

11 = 1011

13 = 1101

11. (a) 115 \rightarrow (1111 01) $_2$

12. (a) 32 \rightarrow (1000 1000 1000 1000) $_2$

$= 2^4 + 2^3 + 2^2 + 2^1 + 2^0$

$= 2^4 + 2^3 + 2^2 + 2^1 + 2^0$

$= 2^4 + 2^3 + 2^2 + 2^1 + 2^0 + 2^4 + 2^3 + 2^2 + 2^1 + 2^0$

$= 16 + 8 + 4 + 2 + 1$

$= 15$

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

$= 93$

$[111101]$

$[0.0101000111010111]$

$[101101]$

$2^{-4} + 2^{-5} + 2^{-6} + 2^{-12} + 2^{-15} + 2^{-19} + 2^{-16} + 2^{-20}$

13. (a) 15/2 = 7 R 1

60/2 = 30 R 0

$[0.0101000111010111]$

$[1111]$

e) 40/2 = 20 R 0

$[101000]$

f)

64/2 = 32 R 0

$[10000001]$

2/2 = 1 R 0

20/2 = 10 R 0

32/2 = 16 R 0

3/2 = 1 R 1

10/2 = 5 R 0

16/2 = 8 R 0

1/2 = 0 R 1

5/2 = 2 R 1

8/2 = 4 R 0

2/2 = 1 R 0

4/2 = 2 R 0

1/2 = 0 R 1

2/2 = 1 R 0

1/2 = 0 R 1

19. c) 1.9028

$0.9028 \times 2 = 1$

$x_2 = 1$

$x_2 = 1$

$x_2 = 0$

$x_2 = 0$

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$x_2 = 0$

$x_2 = 0$

$[0.111001110001110111]$

2.4

15. (e)

$$\begin{array}{r} 1001 \rightarrow 9 \\ + 101 \rightarrow 5 \\ \hline 1110 \end{array} \quad 14$$

f) $11101 \rightarrow 13$
 $+ 1011 \rightarrow 11$
 $\hline 11000 \quad 24$

16. d) $111010 \rightarrow 14$
 $- 11 \rightarrow 3$
 $\hline 11011$

f) $111010 \rightarrow 26$
 $- 10111 \rightarrow 23$
 $\hline 00011 \quad 3$

17. (e) 1101×1101
 $\begin{array}{r} 1101 \\ \times 1101 \\ \hline 11101 \\ , 00000 \\ , 110100 \\ + 1101000 \\ \hline 110101001 \end{array}$

f) 1110×1101
 $\begin{array}{r} 1110 \\ \times 1101 \\ \hline 1110 \\ , 00000 \\ , 111000 \\ + 1110000 \\ \hline 110110110 \end{array}$

18. (b) $11 \sqrt{1001}$
 $11 \times 3 = 33$
 $\hline 1001$

21. d) $11010111 \rightarrow 100101000$
 e) $1110101 \rightarrow 0001010$

2.5

20. zero inverts to 10

$$\begin{array}{r} 0 \rightarrow \\ 1 \\ + 1 \\ \hline 10 \end{array}$$

22. a) $10 \rightarrow 111000$
 $+ 000111$
 $\hline 001000$

2.6

23. (b) -85

$$11010101$$

c) 100
 01100100

24. c) -99

$$11100011$$

d) 115

$$01110011$$

25 b) -68

$$\begin{array}{r} 01000100 \\ 10111011 \\ + 1 \\ \hline 10111100 \end{array}$$

d) -125

$$\begin{array}{r} 0111101 \\ 10000010 \\ + 1 \\ \hline 10000011 \end{array}$$

28. (b) $01110100 \leftarrow 116$

$$10001100$$

$$-2^7 + 2^3 + 2^2 = -116$$

2.7

31. $246_{10} = 11110110 \rightarrow$
 $+ 25_{10} = 11001 \rightarrow$
 $\hline 10000111$

32. $101110000 \leftarrow +112$
 $+ 10101111 \leftarrow -81$
 $\hline 101001111 \leftarrow +31$

34 $\sqrt{1610101} \rightarrow +101$
 $- 11101000 \rightarrow -24$
 $\hline 10111001 \quad 125$

2-8

38. (e) 111110000 (f) 1001100000

0011 1111 0000 0010
3 15 0 1000 2
1001 8

$3F_{16}$

9

$16 \ 180 \ 210$

$16 = 11 \ R \ 4$

$16 = 0 \ R \ 11$

982_{16}

40. (f) 2890

1011 0100 1010

$= B4A_{16}$

(g) 4019

1111 1011 0011

$= FB3_{16}$

42. $FD_{16} - 88_{16}$

$253 - 136$

$= 117$ or $C8_{16}$

2.9

44. (g) $219 \div 8 = 27 \ R \ 3$

$27 \div 8 = 3 \ R \ 3$

$3 \div 8 = 0 \ R \ 3$

333_8

46. (i) 1111110110000

7 7 5 7 0

$= 77570_8$

48. a)

$10 \rightarrow \begin{matrix} 0001 & 0000 \\ 1010_2 \end{matrix} \rightarrow \begin{matrix} 8 \text{ bit} \\ 4 \text{ bit} \end{matrix}$

b)

$13 \rightarrow \begin{matrix} 0001 & 0011 \\ 1101_2 \end{matrix} \rightarrow \begin{matrix} 8 \text{ bit} \\ 4 \text{ bit} \end{matrix}$

f) $36 \rightarrow \begin{matrix} 0011 & 0110 \\ 10010_2 \end{matrix} \rightarrow \begin{matrix} 8 \text{ bit} \\ 4 \text{ bit} \end{matrix}$

50. e)

$\begin{matrix} 0001 & 1001 \\ 1 & 9 \end{matrix} \rightarrow 19$

54. f) $\begin{matrix} 01106101 \\ + 01011000 \\ \hline 11011101 \\ + 01100110 \\ \hline 000150100011 \end{matrix}$

$\begin{matrix} 0001 & 50 & 1000 & 11 \\ 1 & 2 & 3 \end{matrix}$

h) $\begin{matrix} 0010 & 1001 & 0101 \\ + 0001 & 0101 & 0111 \\ \hline 0011 & 1110 & 1100 \\ + & 0110 & 0110 \\ \hline 0100 & 0101 & 0010 \end{matrix}$

$\begin{matrix} 0100 & 0101 & 0010 \\ 4 & 5 & 2 \end{matrix}$

58. g) 56 ASCII = 8

i) 10^7 ASCII = K

60) Hello. How are you?

62)

011011	0110000	0100000	1001001	1001110
1010000	1010101	1010100	0100000	1000001
0101100	0100000	1000010		

64 c) Error, there are even amount of 1's

65 b) 000001001