

Tutorial 2 (Number Systems)

1. Convert the following binary numbers to decimal
 - (a) 110011.11
 - (b) 101010.01
 - (c) 1111111.11111
 - (d) 11
 - (e) 1000
 - (f) 1110001.0001
 - (g) 10111
 - (h) 1111000.101
 - (i) 1010
2. How many bits are required to represent the following decimal numbers?
 - (a) 17
 - (b) 35
 - (c) 49
 - (d) 68
 - (e) 81
 - (f) 114
3. Convert each decimal number to binary by using the sum-of-weight method.
 - (a) 10
 - (b) 17
 - (c) 24
 - (d) 48
 - (e) 61
 - (f) 93
 - (g) 125
 - (h) 186
4. Convert each decimal fraction number to binary by using the sum-of-weight method.
 - (a) 0.32
 - (b) 0.246
 - (c) 0.0981
5. Convert each decimal number to binary by using repeated division by 2.
 - (a) 15
 - (b) 21
 - (c) 28
 - (d) 34
 - (e) 40
 - (f) 59
 - (g) 65
 - (h) 73
6. Convert each decimal fraction number to binary by using repeated multiplication by 2.
 - (a) 0.98
 - (b) 0.347
 - (c) 0.9028
7. Add the binary numbers
 - (a) $11 + 01$
 - (b) $10 + 10$
 - (c) $101 + 11$
 - (d) $111 + 110$
 - (e) $1001 + 101$
 - (f) $1101 + 1011$
8. Use direct subtraction on the following binary numbers
 - (a) $11 - 1$
 - (b) $101 - 100$
 - (c) $110 - 101$
 - (d) $1110 - 11$
 - (e) $1100 - 1001$
 - (f) $11010 - 10111$

9. Perform the following binary multiplication.

- (a) 11×11 (b) 100×10 (c) 111×101
(d) 1001×110 (e) 1101×1101 (f) 1110×1101

10. Divide the binary numbers as indicated

- (a) $100 \div 10$ (b) $1001 \div 11$ (c) $1100 \div 100$

11. Determine the 1' complement of each binary number

- (a) 101 (b) 110 (c) 1010
(d) 11010111 (e) 1110101 (f) 00001

12. Determine the 2's complement of each binary number using either method

- (a) 10 (b) 111 (c) 1001
(d) 1101 (e) 11100 (f) 10011
(g) 10110000 (h) 00111101 (i) 11111111

13. Express each decimal number in binary as an 8-bit sign-magnitude number

- (a) +29 (b) -85 (c) +100 (d) -123

14. Express each decimal number as an 8-bit number in the 1's complement form

- (a) -34 (b) +57 (c) -99 (d) +115

15. Express each decimal number as an 8-bit number in the 2's complement form

- (a) +12 (b) -68 (c) +101 (d) -125

16. Determine the decimal value of each signed binary number in the sign-magnitude form

- (a) 10011001 (b) 01110100 (c) 10111111

17. Determine the decimal value of each signed binary number in the 1's complement form

- (a) 10011001 (b) 01110100 (c) 10111111

18. Determine the decimal value of each signed binary number in the 2's complement form

- (a) 10011001 (b) 01110100 (c) 10111111

19. Convert each pair of decimal numbers to binary and add using the 2's complement form

- (a) 33 and 15 (b) 56 and -27 (c) -46 and 25 (d) -110 and -84

20. Perform each addition in the 2's complement form

- (a) 00010110 + 00111001 (b) 01110000 + 10101111
(c) 10001100 + 00111001 (d) 11011001 + 11100111

21. Perform each subtraction in the 2's complement form

- (a) 00110011 – 00010000 (b) 01100101 - 11101000

22. Multiply 01101010 by 11110001 in the 2's complement form

23. Divide 01000100 by 00011001 in the 2's complement form

24. Convert each hexadecimal number to binary

- (a) 38_{16} (b) 59_{16} (c) $A14_{16}$ (d) $5C8_{16}$
(e) 4100_{16} (f) $FB17_{16}$ (g) $8A9D_{16}$ (h) $AAFF_{16}$

25. Convert each binary number to hexadecimal

- (a) 1110 (b) 10 (c) 10111 (d) 10100110
(e) 1111110000 (f) 100110000010 (g) 10101010 (h) 01100001

26. Convert each hexadecimal number to decimal

- (a) 23_{16} (b) 92_{16} (c) $1A_{16}$ (c) $8D_{16}$
(d) $F3_{16}$ (e) EB_{16} (f) $5C2_{16}$ (g) 700_{16}

27. Convert each decimal number to hexadecimal

- (a) 8 (b) 14 (c) 33 (d) 52
(e) 284 (f) 2890 (g) 4019 (h) 6500

28. Perform the following additions

- (a) $37_{16} + 29_{16}$ (b) $A0_{16} + 6B_{16}$ (c) $FF_{16} + BB_{16}$

29. Perform the following subtraction

- (a) $51_{16} - 40_{16}$ (b) $C8_{16} - 3A_{16}$ (c) $FD_{16} - 88_{16}$

30. Convert each of the following decimal numbers to 8421 BCD

- (a) 10 (b) 13 (c) 18 (d) 21 (e) 25 (f) 36
(g) 44 (h) 57 (i) 69 (j) 98 (k) 125 (l) 156

31. Convert each of the BCD numbers to decimal

- (a) 10000000 (b) 0001011010000011 (c) 001000110111
(d) 1001000000011000 (e) 001101000110 (f) 100000000000

32. Express the following binary numbers in Octal

- (a) 1001011000001110_2 (b) 111111111000011_2 (c) 11010001101100101010_2

33. Express the following octal numbers in decimal

- (a) 3702_8 (b) 7176_8 (c) 3010_8 (d) 4010_8

34. Convert the decimal number to octal

- (a) 1986_{10} (b) 7176_{10} (c) 3010_{10} (d) 4010_{10}