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**LAB 1: NUMBER SYSTEMS**

1. Convert the following binary numbers to decimal:

a) 11 = 3

b) 100 = 4

c) 111= 7

d) 1000 = 8

e) 1001 = 9

f) 1100 = 11

g) 1011 = 11

h) 1111 = 15

2. Convert each binary number to decimal:

a) 110011.11 = 51.75

b) 101010.01 = 42.25

c) 1000001.111 = 65.875

d) 1111000.101 = 120.625

e) 1011100.10101 = 92,65625

f) 1110001.0001 = 113.0625

g) 1011010.1010 = 90.625

h) 1111111.11111 = 127.96875

3. How many bits are required to represent the following decimal numbers?

(a) 17 : 5 bit (b) 35 : 6 bits

(c) 49 : 6 bits (d) 68 : 7 bits

(e) 81 : 7 bits (f) 114 : 7 bits

(g) 132 : 8 bits (h) 205 : 8 bits

4. Convert each decimal number to binary by using the sum-of-weights method:

(a) 10 = 00001010

(b) 17 = 00010001

(c) 24 = 00011000

(d) 48 = 0110000

5. Convert each decimal fraction to binary using the sum-of-weights method:

(a) 0.32 = 0.01010

(b) 0.246 = 0.00111

(c) 0.0981 = 0.00011

(d) 0.75 = 0.11

6. Convert each decimal number to binary using repeated division by 2:

(a) 15 = 1111

(b) 21 = 10101

(c) 28 = 11100

(d) 34 = 10010

7. Convert each decimal fraction to binary using repeated multiplication by 2:

(a) 0.98 = 0.111110

(b) 0.347 = 0.01011

(c) 0.9028 = 0.11100111

8. Add the binary numbers:

(a) 11 + 01 = 100

(b) 111 + 110 = 01101

(c) 1001 + 101 = 01110

(d) 1101 + 1011 = 11000

9. Use direct subtraction on the following binary numbers:

(a) 1110 – 11 = 01011

(b) 101 – 100 = 1

(c) 1100 – 1001 = 0011

(d) 11010 – 10111 = 011

10. Perform the following binary multiplications:

(a) 1101 x 1101 = 010101001

(b) 111 x 101 = 100011

(c) 1110 x 1101 = 010110110

11. Divide the binary numbers as indicated:

(a) 100 / 10 = 10

(b) 1001 / 11 = 11

(c) 1100 / 100 = 011

12. Determine the 1's complement of each binary number:

(a) 101 = 010

(b) 110 = 001

(c) 1010 = 0101

(d) 11010111 = 00101000

(e) 1110101 = 0001010

(f) 00001 = 00010

13\*\*. Determine the 2's complement of each binary number using either method:

(a) 10 = 10

(b) 111 = 1

(c) 1001 = 111

(d) 1101 = 11

(e) 11100 = 100

(f) 10011 = 1101

(g) 10110000 = 01010000

(h) 00111101 = 11000011

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

(a) +29 = 00011101

(b) -85 = 10101011

(c) + 100 = 01100100

(d) -123 = 10000101

15\*\*. Express each decimal number as an 8-bit number in the 1's complement form:

(a) -34 = 1101 1110

(b) +57 = 11 1001

(c) -99 = 1001 1101

(d) +115 = 111 0011

16\*\*. Express each decimal number as an 8-bit number in the 2's complement form:

(a) + 12 = 1100

(b) -68 = 1011 1100

(c) + 101 = 110 0101

(d) -125 = 1000

17. Convert each hexadecimal number to binary:

(a) 3816 = 00111000

(b) 5916 = 01011001

(c) A1416 = 101000010100

(e) 410016 = 0100000100000000

(f) FBl716 = 0100000100000000

(g) 8A9D16 = 1000101010011101

18. Convert each octal number to decimal:

(a) 128 = 10

(b) 1038 = 67

(c) 10248 = 532

(d) 77658 = 4085