

PRACTICE QUESTIONS

LECTURE 1, 2 AND 3

1. Express following numbers as decimal
 - a. $(10110.0101)_2$ 22.3125
 - b. $(26.24)_8$ 22.3125
 - c. $(16.5)_{16}$ 22.3125
 - d. $(1010.1010)_2$ 10.625
2. Obtain 1's complement and 2's complement of the following binary numbers
 - a. 10000000 01111111
 - b. 11011010 00100101
 - c. 01110110 10001001
 - d. 10000101 01111010
3. Perform subtraction on the given numbers using 2's complement.
 - a. $10011-10001$ 01010
 - b. $1001-101000$ 100101
 - c. $110000-10101$ 011011
4. Suppose an analog audio signal comes in over a wire and the voltage on the wire can range from 0 V to 3 V. You want to convert the analog signal to a digital signal. You can decide to encode each sample using two bits, such that 0 V would be encoded as 00, 1 V as 01, 2 V as 10 and 3 V as 11. Suppose when you sample the signal every millisecond and detect the following sequence of voltages: 0 0 1 2 2 3 2 1 2 0. Represent this signal in binary.
00000110101110011000
5. Suppose 0 V is encoded as 00, 1 V as 01, 2 V as 10 and 3 V as 11. If you are given a digital encoding of an audio signal as 1111101001010000. Plot the recreated signal with time on x axis and voltage on y axis. Assume that each encoding's corresponding voltage should be output for one millisecond.
6. Convert the following binary numbers to hexadecimal
 - a. 11001101 CD
 - b. 11101111 EF
 - c. 011001101101101 336D
 - d. 1101101111100 1B7C
7. Convert following hexadecimal numbers to binary
 - a. 4F5E 0111010101001110
 - b. 3E2A 0011111000101010

- c. FF 11111111
- d. F0A2 1111000010100010
- e. 100 000100000000

8. What is the range of numbers that you can represent using 5 bits in

- a. Unsigned representation 0 to +31
- b. Sign magnitude representation -15 to +15
- c. 1's complement representation -15 to +15
- d. 2's complement representation -16 to +15

9. Convert the following numbers

- a. $(1431)_8$ to base 10 793
- b. 11001010.0101 to base 8 and base 10 312.24, 202.3125
- c. $(1984)_{10}$ to base 8 3700
- d. $(1776)_{10}$ to base 16 6F0
- e. $(53.1575)_{10}$ to base 2 110101.00101000010100011111

10. Given that $(16)_{10} = (100)_b$, find the value of b.

11. Write a truth table for a circuit having three inputs A, B and D and outputs S and C. The circuit performs addition of the three inputs. The outputs S and C stand for sum and carry respectively. From the truth table, draw the circuit using logic gates that generates the output S.

12. A majority gate produces a 'TRUE' output only if more than half of its inputs are 'TRUE'. Write a truth table for a 4 input majority gate.

13. A water tank has a capacity of 150cm^3 . In order to discretize the measurement of the water level, we represent the water level in 16 levels. Suppose no water corresponds to level 0 and full tank corresponds to level 15, write the binary equivalent for each level from level 0 to level 15.

Level 0- 0000, level 1- 0001, level2 -0010, level3 -0011, level4 -0100, level5 -0101, level 6 -0110, level7 -0111, level 8 -1000, level 9- 1001, level 10 -1010, level 11- 1011, level 12- 1100, level 13 – 1101, level 14- 1110, level 15- 1111