

## PRACTICE QUESTIONS

### LECTURE 1, 2 AND 3

1. Express following numbers as decimal
  - a.  $(10110.0101)_2$
  - b.  $(26.24)_8$
  - c.  $(16.5)_{16}$
  - d.  $(1010.1010)_2$
2. Obtain 1's complement and 2's complement of the following binary numbers
  - a. 10000000
  - b. 11011010
  - c. 01110110
  - d. 10000101
3. Perform subtraction on the given numbers using 2's complement.
  - a. 10011-10001
  - b. 1001-101000
  - c. 110000-10101
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.
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
  - b. 11101111
  - c. 011001101101101
  - d. 11011011111100
7. Convert following hexadecimal numbers to binary
  - a. 4F5E
  - b. 3E2A
  - c. FF

- d. F0A2
  - e. 100
8. What is the range of numbers that you can represent using 5 bits in
- a. Unsigned representation
  - b. Sign magnitude representation
  - c. 1's complement representation
  - d. 2's complement representation
9. Convert the following numbers
- a.  $(1431)_8$  to base 10
  - b.  $11001010.0101$  to base 8 and base 10
  - c.  $(1984)_{10}$  to base 8
  - d.  $(1776)_{10}$  to base 16
  - e.  $(53.1575)_{10}$  to base 2
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  $150\text{cm}^3$ . 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.