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SKEE 1223 EXERCISE FOR TEST 1

1. Read the following paragraph and fill in the blanks with suitable words from the given list.

Digital techniques and systems have the advantage of being relatively much easier to design and having higher (1) _____ , programmability, noise immunity, easier storage of (2) _____ and ease of fabrication in integrated form, leading to availability of more complex functions in a smaller size. The real world, however, is analogue. Most physical quantities - position, velocity, (3) _____, force, pressure, temperature and flowrate, for example - are analogue in nature. That is why analogue variables representing these quantities need to be (4) _____ or discretized at the input if we want to benefit from the features and facilities that come with the use of digital techniques. In a typical system dealing with analogue inputs and outputs, analogue variables are digitized at the input with the help of an analogue-to-digital converter block and (5) _____ back to analogue form at the output using a digital-to-analogue converter block.

[Adapted from Digital Electronics ; Principles, Devices and Application by Anil K. Maini]

[List of words : bytes, transformed, acceleration, accuracy, digitized, reconverted, counter, resolution, data, package]

2. A hybrid home theatre system is shown in Figure 1. A compact disc (CD) is read by the CD drive. What is the

(i) type of data stored on the CD?

(ii) function of the converter?

(iii) component marked X?

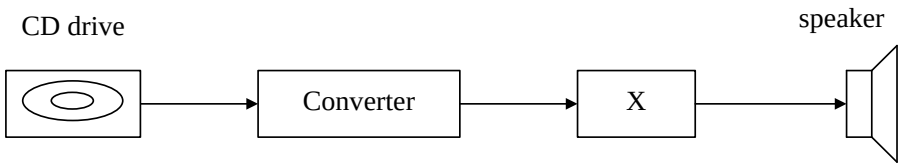


Figure 1

3. In a binary number system, how many

(i) bits are in a byte? (ii) bytes are in a 32-bit string?

(iii) nibbles are in a byte?

4. Give the next number in each of the following sequences;

(a) Gray code : 1010, 1011, …….

(b) Hexadecimal : 9FE, 9FF, …….

(c) BCD : 10011000, 10011001, ……..

5. $(167)_8 = (434)_X$. Find X.

6. Convert

(a) $(10110)_{\text{Gray code}}$ to BCD (b) 5742_8 to hexadecimal.

7. Assume a base 20 number system with 0 to 9 and A to J as its basic digits.

(i) Express $(11101)_2$ in this number system.

(ii) Convert $(2BJ)_{20}$ to decimal.

8. Arrange the following numbers in ascending order:

$(43)_8$, $(00110111)_{BCD}$, $(24)_{16}$, $(00100010)_2$, $(0201)_4$

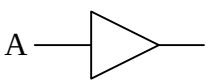
9. Write True or False for each of the following equations;

(a) $(10)_{10} = (1010)_{BCD}$

(b) $(88)_{16} = (10001000)_{BCD}$

(c) $(100010)_{Gray} = (110011)_2$

10. The logic symbol and the truth-table of a buffer are shown in Figure 2.



A	F
0	0
1	1

Figure 2

Implement a buffer using a single two-input

(i) AND gate. (ii) X-OR gate.

11. The pin diagram of 7400 chip (quad 2-input NAND gates) is shown in Figure 3. Identify pin 1 and pin 14 as well as the DC supply V_{CC} and GND pins on the diagram.

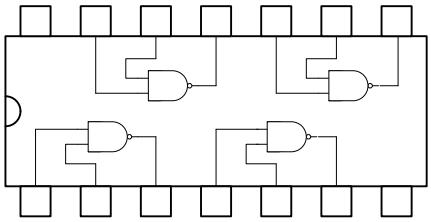


Figure 3

12. Choose the correct statements about the logic gates in Figure 4.

(i) Gate1 is the complement for Gate4.

(ii) Gate2 has the same function as Gate3.

(iii) The complement for Gate2 is Gate1.

(iv) Gate4 has the same function as Gate3.

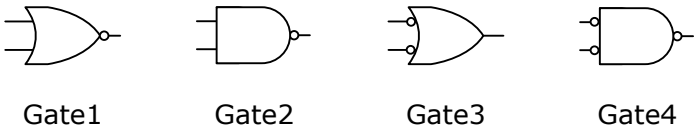
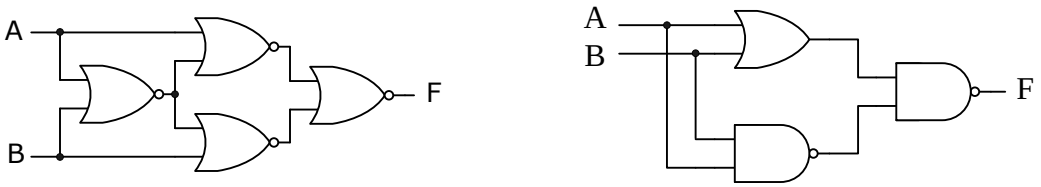


Figure 4

13. The circuits in Figure 5 perform which basic logic functions?



(a) (b)

Figure 5

14. Implement a 3-input AND, OR, NAND, NOR, X-OR and X-NOR functions using minimum number of 2-input AND, OR, NAND, NOR, X-OR and X-NOR gates respectively.

15. Implement a NOT function using a

(i) 3-input NOR gate (ii) 3-input NAND gate

(iii) 2-input X-OR gate. (iv) 2-input X-NOR gate.

16. Implement a

(a) 3-input X-NOR function using minimum number of 2-input X-OR gates.

(b) function F(A,B,C) = A + B.C using minimum number of

(i) 2-input NAND gates (ii) 2-input NOR gates.

17. Without simplifying, draw the NAND equivalent of the circuit in Figure 6.

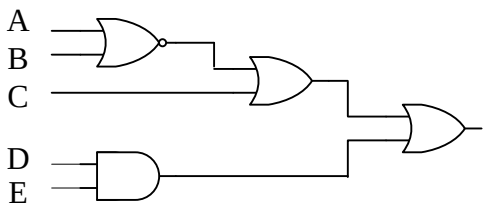


Figure 6

18. If A.B = 0, show that $A \oplus B = A + B$ using Boolean algebra.

19. Determine whether the following Boolean equations are true or otherwise. Each letter represents a variable.

(a) (UTM)+(UITM) = UTM

(b) AB + BA = ABBA

(c) $KL(\overline{KL} + C) = KLCC$

(d) $(FKE) \oplus (FKE) = (UTM) \oplus (UTM)$

20. (i) Obtain the truth table for the function F(A,B,C) = $A.\overline{B} + \overline{B}.C + \overline{A}.B.C$

(ii) Write the canonical SOP and POS expressions for this function and then simplify them in SOP and POS respectively using Boolean algebra.

(iii) Draw the NAND-NAND and NOR-NOR configurations of the simplified function.

21. (i) Simplify the following Boolean expression in SOP by using Boolean algebra; F(A,B,C,D) = $\overline{A.B + \overline{B}.C}.\overline{C.\overline{D}}$

(ii) Implement the simplified expression from (i) using two ICs – a quad two-input NAND (7400) gates and a triple three-input NAND (7410) gates.