University of Sargodha

BS 2nd Semester/Ferm Exam 2021

Subject: Information Technology

Paper: Digital Logic and Design (ITSC-102)

Time Allowed: 02:30 Hours

Maximum Marks: 60

Note: Objective part is compulsory. Attempt any three questions from subjective part.

Objective Part (Compulsory)

Q.1. Write short answers of the following in 2-3 lines each on your answer sheet.

(2*12)

- i. What are literals?
- ii. Write dual of $0 \cdot 1 = 1 \cdot 0 = 0$
- il. Define null element theorem
- iv. . What are decoders?
- What are priority circuits?
- vi. What are arithmetic circuits?
- vij! . What is a propagation delay?
- viii. What is minimum number of bits that can be added using a full adder?
- ix. \ What are synchronous sequential circuits?
- x. A flip-flop copies input to output on which edge of the clock?
- xi. A divide-by-N counter has how many outputs?
- xii. What is a synchronizer?

Subjective Part (3*12)

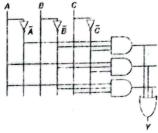
Q.2. Simplify the following Boolean equations using Boolean theorems. Check for correctness using a truth table or K-map.

 $Y = \overline{A} \overline{B} \overline{C} \overline{D} + A \overline{B} \overline{C} + A \overline{B} C \overline{D} + A B D + \overline{A} \overline{B} C \overline{D} + B \overline{C} D + \overline{A}$

- Q.3. Draw a 4:1 multiplexer with minimum number of gates.
- Q.4. Following table shows the truth table for a Boolean function Y. Using De Morgan's Theorem, derive the product-of-sums canonical form of Y from the sum-of-products form of complement of Y.

| A B C D Y 0 0 0 0 0 1 0 0 0 1 0 0 0 1 1 0 1 0 0 0 1 1 0 1 0 0 0 1 1 0 1 0 1 0 1 1 0 1 1 0 1 0 0 1 1 1 0 1 1 0 1 0 0 1 1 1 1 1 0 1 1 1 0 1 1 1 1 0 1 1 1 0 1 1 1 0 1 1 1 0 1 1 1 1 0 0 1 1 1 1 | A | B | C | D | Y |
|--|---|---|---|---|---|
| 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 1 0 0 1 1 1 1 1 0 1 1 1 0 1 | 0 | 0 | 0 | 0 | 1 |
| 0 0 1 0 0 0 0 1 1 1 0 1 0 0 0 0 1 1 1 0 1 0 1 1 0 1 1 0 1 0 1 1 0 1 1 0 0 0 0 1 0 0 1 1 1 0 1 0 1 1 1 0 1 0 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 1 0 | 0 | 0 | 0 | 1 | 0 |
| 0 0 1 1 1 0 0 0 0 0 1 1 1 0 1 0 1 1 1 0 1 | 0 | 0 | 1 | 0 | 0 |
| 0 1 0 0 0 0 0 0 0 1 1 0 1 0 1 1 0 1 1 1 1 0 1 | 0 | 0 | 1 | 1 | 1 |
| 0 1 0 1 1 0 1 1 0 1 1 1 0 0 1 0 0 0 0 1 0 0 1 1 1 0 1 0 1 1 0 1 1 0 1 1 0 0 1 1 1 0 0 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 | 0 | 1 | 0 | 0 | 0 |
| 0 1 1 0 1 0 2 1 1 0 1 0 0 0 0 1 0 0 1 1 1 0 1 0 1 1 0 1 0 1 1 0 0 1 1 1 0 0 1 1 1 0 0 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 | 0 | 1 | û | 1 | 1 |
| 0 1 1 1 0 1 0 0 0 0 1 0 0 1 1 1 0 1 0 1 1 1 0 0 1 1 1 0 0 1 1 1 0 0 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 0 | 0 | 1 | 1 | 0 | 1 |
| 1 0 0 0 0 0 1 1 1 1 0 1 1 0 0 1 1 1 1 0 0 1 | 0 | 2 | 1 | 1 | 0 |
| 1 0 0 1 1 1 0 1 0 1 1 0 1 1 0 1 1 0 0 1 1 1 0 0 1 1 1 1 0 0 1 1 1 1 | 1 | 0 | 0 | O | 0 |
| 1 0 1 0 1 1 0 1 1 0 1 1 0 0 1 1 1 0 0 0 1 1 1 0 0 1 1 1 1 | 1 | 0 | 0 | 1 | 1 |
| 1 0 1 1 0 1 1 0 0 1 1 1 0 0 0 1 1 1 0 0 1 1 1 1 | 1 | 0 | 1 | 0 | 1 |
| 1 1 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 1 | 0 | 1 | 1 | 0 |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 1 | 1 | 0 | 0 | 1 |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 1 | 1 | 0 | 1 | 0 |
| 1 1 1 1 1 | 1 | 1 | 1 | 0 | 0 |
| | 1 | 1 | 1 | 1 | 1 |

Q.5. Given the following logic circuit, draw an equivalent logic circuit with max-terms.



Q.6. Find the propagation delay and contamination delay of the circuit shown in the following circuit. According to his data book, each gate has a propagation delay of 80 picoseconds (ps) and a contamination delay of 50 ps.

