**Assignment # 4**

Please read the following instructions:

1. Please provide a complete solution.
2. Plagiarism or Cheating is not allowed. **Even if you cheat in only one question, you will be marked zero in the *entire* assignment.**
3. SECTION: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
4. ROLL NUMBER: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Total Marks: 30**

**Submission Due date: 3rd January, 2022 (on portal)**

Question No 1: (5 Marks)

Translate each statement into symbolic form. For each component, indicate what letter you used to represent the component. Also state whether the statement is a conjunction, a disjunction, a negation, a conditional, or a biconditional.

1. An angle is a right angle if and only if its measure is 90°.
2. Any angle inscribed in a semicircle is a right angle.
3. If two sides of a triangle are equal in length, the angles opposite those sides are congruent.
4. The sum of the measures of the three angles of any triangle is 180°.
5. The redskins will make the playoffs if they finish the session 0-10.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| P | Q | Symbolic Notation | Prof | Compound Statement |
| An angle is a right angle | its measure is 90°. | P 🡨🡪 q |  | Biconditional |
| Any angle inscribed in a semicircle | Angle is a right angle | P 🡪 q | If any angle inscribed in a semicircle, then angle is a right angle | Conditional |
| Two sides of a triangle are equal in length | the angles opposite those sides are congruent | P 🡪 q | If two sides of a triangle are equal in length, then the angles opposite those sides are congruent | Conditional |
| Any triangle has 3 angles | Sum of measures of three angles is 180 | P and q | Prove according to truth table.\* | Conjunction |
| they finish the session 0-10 | The redskins will make the playoffs | P 🡪 q | If they finish the session 0-10 , then The redskins will make the playoffs | Conditional |

|  |  |  |
| --- | --- | --- |
| Any triangle has 3 angles (p) | Sum of measures of three angles is 180 (q) | P and Q |
| T | T | T |
| T | F | F |
| F | T | F |
| F | F | F |

Question No 2: (5 Marks)

Determine whether each statement is true or false.

|  |  |  |
| --- | --- | --- |
| -4>-11 or -4=-11 | T | -4 is greater than -11 |
| There exists an even prime number | T | 2 is the only even prime number. |
| Some real numbers are irrational. | T | Every real number is not an irrational number |
| All irrational numbers are real numbers. | T | real numbers consist of both rational numbers and irrational numbers. Every irrational number is a real number |
| Every rational number is an integer | F | All integers numbers are rational numbers, but all rational numbers are not integers |

Question No 3: (10 Marks)

use a truth table to determine whether the given statement is a tautology or self-contradiction.

1. ~[p **∧** ( ~p v q)] v q Tautology
2. [p **∧** ( ~p v q)] v q Neither tautology nor self-contradiction
3. ~[(p v q) v ( ~p v q)] self-contradiction
4. ~[p v ( ~p v q)] self-contradiction
5. (P **∧** q) v ( ~p v ~q) Tautology

Truth Tables:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Q | ~P | ~p v q | [p **∧** ( ~p v q)] | ~[p **∧** ( ~p v q)] | ~[p **∧** ( ~p v q)] v q |
| T | T | F | T | T | F | T |
| T | F | F | F | F | T | T |
| F | T | T | T | F | T | T |
| F | F | T | T | F | T | T |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| P | Q | ~P | ~p v q | [p **∧** ( ~p v q)] | [p **∧** ( ~p v q)] v q |
| T | T | F | T | T | T |
| T | F | F | F | F | F |
| F | T | T | T | F | T |
| F | F | T | T | F | F |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Q | ~P | ~p v q | ( p v q)] | [(p v q) v ( ~p v q)] | ~[(p v q) v ( ~p v q)] |
| T | T | F | T | T | T | F |
| T | F | F | F | T | T | F |
| F | T | T | T | T | T | F |
| F | F | T | T | F | T | F |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| P | Q | ~P | ~p v q | [p v ( ~p v q)] | ~[p v ( ~p v q)] |
| T | T | F | T | T | F |
| T | F | F | F | T | F |
| F | T | T | T | T | F |
| F | F | T | T | T | F |

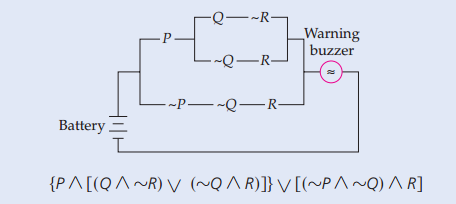
|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| P | Q | ~P | ~q | (P **∧** q) | ( ~p v ~q) | (P **∧** q) v ( ~p v ~q) |
| T | T | F | F | T | F | T |
| T | F | F | T | F | T | T |
| F | T | T | F | F | T | T |
| F | F | T | T | F | T | T |

Question No 4: (10 Marks)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P | Q | R | -P | -Q | -R | {P | And[ | (Q | and | ~R) | V | (~Q | And | R)]} | V | [(~P | And | ~Q) | And | R] |
| T | T | T | F | F | F | T | F | T | F | F | F | F | F | T | F | F | F | F | F | T |
| T | T | F | F | F | T | T | T | T | T | T | T | F | F | F | T | F | F | F | F | F |
| T | F | T | F | T | F | T | T | F | F | F | T | T | T | T | T | F | F | T | F | T |
| T | F | F | F | T | T | T | F | F | F | T | F | T | F | F | F | F | F | T | F | F |
| F | T | T | T | F | F | F | F | T | F | F | F | F | F | T | F | T | F | F | F | T |
| F | T | F | T | F | T | F | F | T | T | T | T | F | F | F | F | T | F | F | F | F |
| F | F | T | T | T | F | F | F | F | F | F | T | T | T | T | T | T | T | T | T | T |
| F | F | F | T | T | T | F | F | F | F | T | F | T | F | F | F | T | T | T | F | F |
|  |  |  |  |  |  | 1 | 12 | 2 | 9 | 3 | 11 | 4 | 10 | 5 | 15 | 6 | 13 | 7 | 14 | 8 |

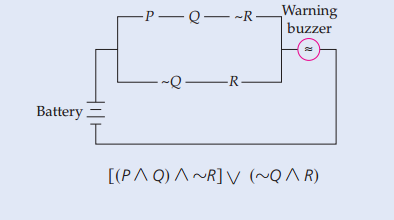
1. The following circuit shows a switching network used in an automobile. The warning buzzer will buzz only when the switching network is closed. Construct a truth table for this switching network.

Solution: Only three cases when circuit is complete as can be seen through step 15;



1. An engineer thinks that the following circuit can be used in place of the circuit in part 1. Do you agree? Hint: Construct a closure table for this switching network and compare your closure table with the closure table in part 1.

Solution: Yes following circuit can be used in place of the circuit in part 1 as can be seen trough truth table, step 9.



|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P | Q | R | -Q | -R | [ | (P | And | Q) | And | ~R] | V | (~Q | and | R) |
| T | T | T | F | F |  | T | T | T | F | F | F | F | F | T |
| T | T | F | F | T |  | T | T | T | T | T | T | F | F | F |
| T | F | T | T | F |  | T | F | F | F | F | T | T | T | T |
| T | F | F | T | T |  | T | F | F | F | T | F | T | F | F |
| F | T | T | F | F |  | F | F | T | F | F | F | F | F | T |
| F | T | F | F | T |  | F | F | T | F | T | F | F | F | F |
| F | F | T | T | F |  | F | F | F | F | F | T | T | T | T |
| F | F | F | T | T |  | F | F | F | F | T | F | T | F | F |
|  |  |  |  |  |  | 1 | 6 | 2 | 7 | 3 | 9 | 4 | 8 | 5 |