|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C | D |
| 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 |

**Foundations of Computer Science – Exercise 1**



A

B

D

C

2. a)

C = A OR B

D = B XOR C = B XOR (A OR B)

b)



A

B

C

D

|  |  |  |  |
| --- | --- | --- | --- |
| A | B | C | D |
| 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 |

C = A AND B

D = B OR C = B OR (A AND B)

c)

E

D

C

A

B

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| A | B | C | D | E |
| 0 | 0 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 0 |

C = A XOR B

D = NOT B

E = C AND D

= (A XOR B) AND (NOT B)

3.



|  |  |  |
| --- | --- | --- |
| a | b | o |
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

* Value of output must be compromised as it not only depends on but also affects the whole operation of the circuit.

4.

a) (P ∨ Q) ∧ P ∧ (Q ∨ R) ∧ (P ∨ ¬ P ∨ ¬ R) ∧ (¬ Q ∨ R)

= (P ∨ Q) ∧ P ∧ (Q ∨ R) ∧ (1 ∨ ¬ R) ∧ (¬ Q ∨ R) (Complementation law)

= (P ∨ Q) ∧ P ∧ (Q ∨ R) ∧ 1 ∧ (¬ Q ∨ R) (Identity law)

= (P ∨ Q) ∧ P ∧ (Q ∨ R) ∧ (¬ Q ∨ R) (Identity law)

= (P ∨ Q) ∧ P ∧ (R ∨ (Q ∧ ¬ Q)) (Distribution law)

= (P ∨ Q) ∧ P ∧ R (Complementation law + Identity law)

= ((P ∧ R) ∧ P) ∨ ((P ∧ R) ∧ Q) (Distribution law)

= (P ∧ R) ∨ ((P ∧ R) ∧ Q) (Idempotence law)

= P ∧ R (Absorption law)

b) ¬ ((P ∨ Q) ∧ ¬ R) (Distribution law)

= ¬ ((P ∧ ¬ R) ∨ (Q ∧ ¬ R)) (De Morgan law)

=¬ (P ∧ ¬ R) ∨ ¬ (Q ∧ ¬ R) (De Morgan law)

= (¬ P ∧ R) ∨ (¬Q ∧ R) (De Morgan law)

|  |  |  |  |
| --- | --- | --- | --- |
| **x** | **y** | **z** | **((x ∧ (y ∨ z)) ∨ (¬y ∧ z))** |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |

5.

DNF:

O = x’y’z + xy’z + xyz’+ xyz

= y’z(x’ + x) + xy’z + xyz’ + xyz

= y’z + xy’z + xyz’+ xyz

= y’z + xy(z’+ z)

= y’z + xy

