***TECNICATURA UNIVERSITARIA EN PROGRAMACIÓN CÁTEDRA DE MATEMÁTICA - COMISIÓN 4 - CASA CENTRAL***

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# Trabajo Practico N3

**EQUIVALENCIAS LOGICAS Y SIMPLIFICACION DE PROPOSIOCIONES COMPUESTAS**

1. Utilizando las leyes y propiedades de la lógica proposicional, simplificar las
2. Demuestre mediante tabla de verdad que son equivalentes. siguientes proposiciones:

# 1. ¬[¬(p˄q)→¬q] ˅q

[¬(p˄q) ˄¬(¬q)] ˅q Negacion de la Condicional

(¬p˅¬q) ˄q] ˅q Ley de De Morgan y de Involucion

(¬p ˄q) ˅q Ley de Absorcion Parcial de la Conjunción

q Ley de Absroción

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| p | q | ¬ | [¬ | (p˄q) | → | ¬q] | ˅ | q | ↔ |
| V | V | F | F | V | V | F | V | V | V |
| V | F | F | V | F | V | V | F | F | V |
| F | V | V | V | F | F | F | V | V | V |
| F | F | F | V | F | V | V | F | F | V |

# 2.[(p˅¬q) ˄q] →p

¬[(p˅¬q) ˄q] ˅p Ley de la Condicional

[¬ (p˅¬q) ˅¬q] ˅p Ley de De Morgan

[(¬p˄q) ˅¬q] ˅p Ley de De Morgan y Ley de Involución

[¬p˅¬q] ˅p Ley de Absorción Parcial

(¬p ˅p) ˅¬q Ley Conmutativa y Asociativa de Disyunción

V ˅ ¬q Condición de Negación

V Condición de Tautología

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| P0 | q | ¬q | [(p˅¬q) | ˄q] | →p | V | ↔ |
| V | V | F | V | V | V | V | V |
| V | F | V | V | F | V | V | V |
| F | V | F | F | F | V | V | V |
| F | F | V | V | F | V | V | V |

3. [(¬p˄q) → (r˄¬r) ] ˄¬q

[¬ (¬p˄q) ˅ (r˄¬r) ] ˄¬q Ley de la Condicional

{[¬ (¬p) ˅ ¬q) ] ˅ F } ˄¬q Ley de De Morgan y Condición de Negación [(p ˅ ¬q) ˅ F ] ˄¬q Ley de Involución

(p ˅ ¬q) ˄¬q Elemento Neutro de Disyunción

¬q Ley de Absorción total

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| p | q | r | [(¬p | ˄q) | → | (r˄¬r) ] | ˄ | ¬q | ↔ |
| V | V | V | F | F | V | F | F | F | V |
| V | V | F | F | F | V | F | F | F | V |
| V | F | V | F | F | V | F | V | V | V |
| V | F | F | F | F | V | F | V | V | V |
| F | V | V | V | V | F | F | F | F | V |
| F | V | F | V | V | F | F | F | F | V |
| F | F | V | V | F | V | F | V | V | V |
| F | F | F | V | F | V | F | V | V | V |

# 04. ¬{[(p↔q) ˄¬p] ˅p}

¬ [(p↔q) ˄ ¬p] ˄ ¬p Ley de De Morgan

[¬ (p↔q) ˅ ¬ (¬p)] ˄ ¬p Ley de De Morgan

[¬ (p↔q) ˅ p] ˄ ¬p Ley de involución

{¬[(p˄q)˅( ¬p˄¬q) ] ˅ p} ˄ ¬p Ley de la Bicondicional

{ [¬ (p˄q) ˄¬( ¬p˄¬q) ] ˅ p} ˄ ¬p Ley de De Morgan

{ [ (¬p˅¬q) ˄( p˅q) ] ˅ p} ˄ ¬p Ley de De Morgan e Involución

{ [ (¬p˅¬q) ˅ p]˄[( p˅q) ˅ p]} ˄ ¬p Ley de Distribución respecto de la disyunción

{ [ (¬p˅p)˅¬q]˄[( p˅p) ˅q]} ˄ ¬p Ley conmutativa y Asociativa

[(V ˅¬q)˄(p˅q)] ˄ ¬p Condición de Negación y Ley de Idempotencia [ V ˄(p˅q)] ˄ ¬p Condición de Tautología

(p˅q) ˄ ¬p Elemento Neutro de la Conjunción

¬p ˄q Ley Absorción Parcial

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P | Q | ¬ | { [(p↔q) | ˄ | ¬p ] | ˅p} | ¬p ˄q | ↔ |
| V | V | F | V | F | F | V | F | V |
| V | F | F | F | F | F | V | F | V |
| F | V | V | F | F | V | F | V | V |
| F | F | F | V | V | V | V | F | V |

# 5.[(¬p˅q) ˄ (¬q→p)] ˅ (p˄¬q)

[(¬p˅q) ˄ (¬(¬q) ˅ p)] ˅ (p˄¬q) Ley Condicional [(¬p˅q) ˄ (q ˅ p)] ˅ (p˄¬q) Ley Involución

[(¬p ˄ p)˅q] ˅ (p˄¬q) Ley Distributiva respecto de la disyunción

(F ˅q) ˅ (p˄¬q) Condición de Negación

(q˅p)˄ (q˅ ¬q) Elemento Neutro de Disyunción y Prop Distributiva.

(q˅p) ˄V Condición de Negación

( q˅p) Elemento Neutro de Conjunción

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| p | Q | [(¬p | ˅q) | ˄ | (¬q | →p)] | ˅ | (p˄¬q) | q˅p | ↔ |
| V | V | F | V | F | F | V | V | F | V | V |
| V | F | F | F | F | V | V | V | V | V | V |
| F | V | V | V | F | F | V | V | F | V | V |
| F | F | V | V | V | V | F | F | F | F | V |

# 06.[(q→p)˄(¬p→q)]→¬(p˅¬q)

¬ [(¬q˅p)˄(p˅q)] ˅¬(p˅¬q) Ley de la Condicional e Involución [¬(¬q˅p) ˅¬ (p˅q)] ˅(¬p˄q) Ley de De Morgan e Involución

[(¬p˄q) ˅(¬p˄¬q)] ˅(¬p˄q) Ley de De Morgan, Involución y conmutativa [(¬p˄q)˅(¬p˄q)] ˅ (¬p˄¬q) Ley conmutativa y asociativa de la disyunción (¬p˄q)˅(¬p˄¬q) Ley idempotencia

¬p˅(q˄¬q) Ley Distributiva de la disyunción

¬p˅F Condición de Negación

¬p Elemento Neutro de Disyunción

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P | Q | [(q→p) | ˄ | (¬p | →q)] | → | ¬ | (p˅¬q) | ↔ |
| V | V | V | V | F | V | F | F | V | V |
| V | F | V | V | F | V | F | F | V | V |
| F | V | F | F | V | V | V | V | F | V |
| F | F | V | F | V | F | V | F | V | V |

# 07. {[(p˄¬r)˅(r˄p)] ˄¬q}˅ [¬p˄ (¬p˅r)]

{[p˅(r˄p)]˄[¬r ˅(r˄p)] ˄¬q}˅ ¬p Ley Distributiva y Absorción

{[p˄(¬r˅p)] ˄¬q}˅ ¬p Ley Absorción Total y Parcial

(p˄¬q)˅ ¬p Ley Absorcion Total

¬q˅ ¬p Ley Absorción Parcial

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| p | Q | r | {[(p˄ | ¬r) | ˅ | (r˄p)] | ˄ | ¬q} | ˅ | [¬p | ˄ | (¬p˅r)] | ¬q˅ ¬p | ↔ |
| V | V | V | F | F | V | V | F | F | F | F | F | V | F | V |
| V | V | F | V | V | V | F | F | F | F | F | F | F | F | V |
| V | F | V | F | F | V | V | V | V | V | F | F | V | V | V |
| V | F | F | V | V | V | F | V | V | V | F | F | F | V | V |
| F | V | V | F | F | F | F | F | F | V | V | V | V | V | V |
| F | V | F | F | V | F | F | F | F | V | V | V | V | V | V |
| F | F | V | F | F | F | F | F | V | V | V | V | V | V | V |
| F | F | F | F | V | F | F | F | V | V | V | V | V | V | V |

# 08.[(p→p)˅q] ˄ [ ¬q˅ (r˄q)] ˄ [p→ (p˅¬q)]

[(¬p˅p) ˅q] ˄ [ (¬q˅r)˄(¬q˅ q)] ˄ [¬p˅ (p˅¬q) Ley Condicional y Distributiva

[ V ˅q] ˄ [ (¬q˅r)˄(V)] ˄ [(¬p˅p)˅¬q] Condicion de Negación y Ley Asociativa De Disyunción

[ V˄ (¬q˅r)] ˄ [V˅¬q] Cond. De Tautología, Elemento Neutro de Disyuncion, Condicion de Neg.

. (¬q˅r) ˄ V Elem. Neutro de Conjuncion, Condicion de Tautologia

¬q˅r Elem. Neutro de Conjuncion

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| p | Q | R | [(p→p) | ˅q] | ˄ | [ ¬q | ˅ | (r˄q)] | ˄ | [p→ | (p˅¬q)] | ¬q˅r | ↔ |
| V | V | V | V | V | V | F | V | V | V | V | V | V | V |
| V | V | F | V | V | F | F | F | F | F | V | V | F | V |
| V | F | V | V | V | V | V | V | F | V | V | V | V | V |
| V | F | F | V | V | V | V | V | F | V | V | V | V | V |
| F | V | V | V | V | V | F | V | V | V | V | F | V | V |
| F | V | F | V | V | F | F | F | F | F | V | F | F | V |
| F | F | V | V | V | V | V | V | F | V | V | V | V | V |
| F | F | F | V | V | V | V | V | F | V | V | V | V | V |

# 09. [¬(p˅q)˅(¬p˄q)]→(¬p˄q)

¬[¬ (p˅q)˅(¬p˄q)] ˅ (¬p˄q) Ley de la Condicional

[(p˅q) ˄¬ (¬p˄q)] ˅ (¬p˄q) Ley de De Morgan e Involucion [(p˅q) ˄(p˅¬q)] ˅ (¬p˄q) Ley de De Morgan e Involucion [(p˄(q˅¬q)] ˅ (¬p˄q) Ley Distributiva

[(p˄V] ˅ (¬p˄q) Condicion de Negacion

p ˅q Elemento Neutro de Conjuncion y Ley Abs. Parcial.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P | Q | [¬ | (p˅q) | ˅ | (¬p | ˄q)] | → | (¬p˄q) | (p˅q) | ↔ |
| V | V | F | V | F | F | F | V | F | V | V |
| V | F | F | V | F | F | F | V | F | V | V |
| F | V | F | V | V | V | V | V | V | V | V |
| F | F | V | F | V | V | F | F | F | F | V |

1. Demuestre que las siguientes proposiciones lógicas son equivalentes. 01- [(p→q)→(r→s)]↔ [¬(¬s→¬r)→(¬q→¬p)]

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| p | q | r | s | [(p→q) | → | (r→s)] | ↔ | [¬ | (¬s | → | ¬r) | → | ¬ | (¬q | → | ¬p)] |
| V | V | V | V | V | V | V | V | F | F | V | F | V | F | F | V | F |
| V | V | V | F | V | F | F | V | V | V | F | F | F | F | F | V | F |
| V | V | F | V | V | V | V | V | F | F | V | V | V | F | F | V | F |
| V | V | F | F | V | V | V | V | F | V | V | V | V | F | F | V | F |
| V | F | V | V | F | V | V | V | F | F | V | F | V | V | V | F | F |
| V | F | V | F | F | V | F | V | V | V | F | F | V | V | V | F | F |
| V | F | F | V | F | V | V | V | F | F | V | V | V | V | V | F | F |
| V | F | F | F | F | V | V | V | F | V | V | V | V | V | V | F | F |
| F | V | V | V | V | V | V | V | F | F | V | F | V | F | F | V | V |
| F | V | V | F | V | F | F | V | V | V | F | F | F | F | F | V | V |
| F | V | F | V | V | V | V | V | F | F | V | V | V | F | F | V | V |
| F | V | F | F | V | V | V | V | F | V | V | V | V | F | F | V | V |
| F | F | V | V | V | V | V | V | F | F | V | F | V | F | V | V | V |
| F | F | V | F | V | F | F | V | V | V | F | F | F | F | V | V | V |
| F | F | F | V | V | V | V | V | F | F | V | V | V | F | V | V | V |
| F | F | F | F | V | V | V | V | F | V | V | V | V | F | V | V | V |

02.[(p→q) →r] ↔ [(p˅r) ˄ (¬q˅r)]

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| P | Q | r | [(p→q) | → r] | ↔ | [(p˅r) | ˄ | (¬q˅r)] |
| V | V | V | V | V | V | V | V | V |
| V | V | F | V | F | V | V | F | F |
| V | F | V | F | V | V | V | V | V |
| V | F | F | F | V | V | V | V | V |
| F | V | V | V | V | V | V | V | V |
| F | V | F | V | F | V | F | F | F |
| F | F | V | V | V | V | V | V | V |
| F | F | F | V | F | V | F | F | V |

03.[(p˄q)˅r]˅s↔ ¬[¬(p˄q) →r] →s

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| p | q | r | s | [(p˄q) | ˅r] | ˅s | ↔ | ¬ | [¬ | (p˄q) | →r] | →s |
| V | V | V | V | V | V | V | V | F | F | V | V | V |
| V | V | V | F | V | V | V | V | F | F | V | V | V |
| V | V | F | V | V | V | V | V | F | F | V | V | V |
| V | V | F | F | V | V | V | V | F | F | V | V | V |
| V | F | V | V | F | V | V | V | F | V | F | V | V |
| V | F | V | F | F | V | V | V | F | V | F | V | V |
| V | F | F | V | F | F | V | V | V | V | F | F | V |
| V | F | F | F | F | F | F | V | V | V | F | F | F |
| F | V | V | V | F | V | V | V | F | V | F | V | V |
| F | V | V | F | F | V | V | V | F | V | F | V | V |
| F | V | F | V | F | F | V | V | V | V | F | F | V |
| F | V | F | F | F | F | F | V | V | V | F | F | F |
| F | F | V | V | F | V | V | V | F | V | F | V | V |
| F | F | V | F | F | V | V | V | F | V | F | V | V |
| F | F | F | V | F | F | V | V | V | V | F | F | V |
| F | F | F | F | F | F | F | V | V | V | F | F | F |

04. ¬ (p˄q˄r) ↔ ( ¬p˅¬q˅¬r)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| p | q | r | ¬ | (p˄q˄r) | ↔ | ( ¬p | ¬q | ¬r) | ˅ |
| V | V | V | F | V | V | F | F | F | F |
| V | V | F | V | F | V | F | F | V | V |
| V | F | V | V | F | V | F | V | F | V |
| V | F | F | V | F | V | F | V | V | V |
| F | V | V | V | F | V | V | F | F | V |
| F | V | F | V | F | V | V | F | V | V |
| F | F | V | V | F | V | V | V | F | V |
| F | F | F | V | F | V | V | V | V | V |

05. p→[¬p→(q→r)]↔(p˄¬p˄q)→r

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| p | q | r | p→ | [¬p | → | (q→r)] | ↔ | (p˄¬p˄q) | →r |
| V | V | V | V | F | V | V | V | F | V |
| V | V | F | V | F | V | V | V | F | V |
| V | F | V | V | F | V | F | V | F | V |
| V | F | F | V | F | V | V | V | F | V |
| F | V | V | V | V | V | V | V | F | V |
| F | V | F | V | V | F | F | V | F | V |
| F | F | V | V | V | V | V | V | F | V |
| F | F | F | V | V | V | V | V | F | V |