**Valid or Invalid**

Using truth tables, determine if the following arguments are valid or invalid. If an argument is invalid, circle the row(s) on the truth table that demonstrate the invalidity.

1. P∨Q

P

∴¬Q

INVALID

|  |  |  |  |
| --- | --- | --- | --- |
| **P** | **Q** | **P∨Q** | **¬Q** |
| T | T | T | F |
| T | F | T | T |
| F | T | T | F |
| F | F | F | T |

2. P→Q

¬Q

∴¬P

VALID

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **P** | **Q** | P→Q | **¬Q** | **¬P** |
| T | T | T | F | F |
| T | F | F | T | F |
| F | T | T | F | T |
| F | F | T | T | T |

3. P↔Q

Q→R

∴Q→(P•R)

VALID

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **P** | **Q** | **R** | **P↔Q** | **Q→R** | **P•R** | **Q→(P•R)** |
| T | T | T | T | T | T | T |
| T | T | F | T | F | F | F |
| T | F | T | F | T | T | T |
| T | F | F | F | T | F | T |
| F | T | T | F | T | F | F |
| F | T | F | F | F | F | F |
| F | F | T | T | T | F | T |
| F | F | F | T | T | F | T |

4. P•Q

∴¬(¬P∨¬Q)

VALID

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **P** | **Q** | **P•Q** | **¬P** | **¬Q** | **¬P∨¬Q** | **¬(¬P∨¬Q)** |
| T | T | T | F | F | F | T |
| T | F | F | F | T | T | F |
| F | T | F | T | F | T | F |
| F | F | F | T | T | T | F |

5. P→(Q∨R)

¬(P→Q)

∴R

VALID

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **P** | **Q** | **R** | **Q∨R** | **P→(Q∨R)** | **P→Q** | **¬(P→Q)** |
| T | T | T | T | T | T | F |
| T | T | F | T | T | T | F |
| T | F | T | T | T | F | T |
| T | F | F | F | F | F | T |
| F | T | T | T | T | T | F |
| F | T | F | T | T | T | F |
| F | F | T | T | T | T | F |
| F | F | F | F | T | T | F |

6. ∴P→(Q∨¬Q)

VALID

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **P** | **Q** | **¬Q** | **Q∨¬Q** | **P→(Q∨¬Q)** |
| T | T | F | T | T |
| T | F | T | T | T |
| F | T | F | T | T |
| F | F | T | T | T |

7 (P→Q)•(R→S)

P∨R

∴Q∨S

VALID

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **P** | **Q** | **R** | **S** | **P→Q** | **R→S** | **(P→Q)•(R→S)** | **P∨R** | **Q∨S** |
| T | T | T | T | T | T | T | T | T |
| T | T | T | F | T | F | F | T | T |
| T | T | F | T | T | T | T | T | T |
| T | T | F | F | T | T | T | T | T |
| T | F | T | T | F | T | F | T | T |
| T | F | T | F | F | F | F | T | F |
| T | F | F | T | F | T | F | T | T |
| T | F | F | F | F | T | F | T | F |
| F | T | T | T | T | T | T | T | T |
| F | T | T | F | T | F | F | T | T |
| F | T | F | T | T | T | T | F | T |
| F | T | F | F | T | T | T | F | T |
| F | F | T | T | T | T | T | T | T |
| F | F | T | F | T | F | F | T | F |
| F | F | F | T | T | T | T | F | T |
| F | F | F | F | T | T | T | F | F |

8. P→Q

Q→P

∴P∨Q

INVALID

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **P** | **Q** | **P→Q** | **Q→P** | **P∨Q** |
| T | T | T | T | T |
| T | F | F | T | T |
| F | T | T | F | T |
| F | F | T | T | F |