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CS 510 – HW 4

2.25.’16

Problem 1: Ch. 7 - Q. 7.10

1. Smoke → Smoke VALID

¬Smoke v Smoke (Definition of implication)

True (Valid definition of v)

1. Smoke → Fire INVALID

¬Smoke v Fire (Definition of implication)

False (Unsatisfiable)

1. (Smoke → Fire) → (¬Smoke → ¬Fire) INVALID

(¬Smoke v Fire) → (Smoke v ¬Fire) (Definition of implication)

¬(¬Smoke v Fire) v (Smoke v ¬Fire) (Definition of implication)  
(¬ (¬Smoke) ^ ¬Fire)) v (Smoke v ¬Fire) (De Morgan’s laws)

(Smoke ^ ¬Fire) v (Smoke v ¬Fire) (Remove double negation)

(Smoke ^ ¬Fire) v Smoke v ¬Fire (Associativity of v)

False (Unsatisfiable)

1. Smoke v Fire v ¬Fire VALID  
   Smoke v True (Definition of v)

True (Definition of v)

1. ((Smoke ^ Heat) → Fire) ↔ ((Smoke → Fire) v (Heat → Fire)) VALID

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Smoke | Heat | Fire | (Smoke ^ Heat) | ((Smoke ^ Heat) → Fire) | (Smoke → Fire) | (Heat → Fire) | ((Smoke → Fire) v (Heat → Fire)) | Result |
| 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 |
| 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

1. (Smoke → Fire) → ((Smoke ^ Heat) → Fire) VALID

(¬Smoke v Fire) → (¬(Smoke ^ Heat) v Fire) (Definition of implication)

¬(¬Smoke v Fire) v (¬(Smoke ^ Heat) v Fire) (Definition of implication)

(Smoke ^ ¬Fire) v (¬Smoke v ¬Heat) v Fire) (De Morgan’s laws)

(Smoke ^ ¬Fire) v ¬Smoke v ¬Heat v Fire (Associativity of v)

True (Definition of v)

1. Big v Dumb v (Big → Dumb) VALID

Big v Dumb v (¬Big v Dumb) (Definition of implication)

Big v Dumb v ¬Big v Dumb (Associativity of v)

Big v ¬Big v Dumb v Dumb (Commutativity of v)

True v Dumb (Definition of v)

True (Definition of v)