Exercise 7.13

1. $Smoke \Rightarrow Smoke$

   $\equiv \neg Smoke \vee Smoke \quad \equiv True$

   Valid

2. $Smoke \Rightarrow Fire$

   $\equiv \neg Smoke \vee Fire$

   Neither

3. $(Smoke \Rightarrow Fire) \Rightarrow (\neg Smoke \Rightarrow \neg Fire)$

   $\equiv (\neg Smoke \vee Fire) \Rightarrow (\neg\neg Smoke \vee \neg Fire)$

   $\equiv (\neg Smoke \vee Fire) \Rightarrow (Smoke \vee \neg Fire)$

   $\equiv \neg(\neg Smoke \vee Fire) \vee (Smoke \vee \neg Fire)$

   $\equiv (Smoke \wedge \neg Fire) \vee Smoke \vee \neg Fire$

   $\equiv (Smoke \vee Smoke \vee \neg Fire) \wedge (\neg Fire \vee Smoke \vee \neg Fire)$

   $\equiv (Smoke \vee \neg Fire) \wedge (\neg Fire \vee Smoke)$

   $\equiv \neg Fire \vee Smoke$

   Neither

4. $Smoke \vee Fire \vee \neg Fire$

   $\equiv Smoke \vee True \quad \equiv True$

   Valid

5. $((Smoke \wedge Heat) \Rightarrow Fire) \Leftrightarrow ((Smoke \Rightarrow Fire) \vee (Heat \Rightarrow Fire))$

$\equiv (\neg Smoke \vee \neg Heat \vee Fire) \Leftrightarrow (\neg Smoke \vee Fire \vee \neg Heat \vee Fire)$

$\equiv (\neg Smoke \vee \neg Heat \vee Fire) \Leftrightarrow (\neg Smoke \vee \neg Heat \vee Fire)$

(设 $A = \neg Smoke \vee \neg Heat \vee Fire$)

$\equiv A \Leftrightarrow A \equiv (A \Rightarrow A) \wedge (A \Rightarrow A) \equiv (\neg A \vee A) \wedge (\neg A \vee A)$

$\equiv True \wedge True \equiv True$

Valid

6. $Big \vee Dump \vee (Big \Rightarrow Dump)$

$\equiv Big \vee Dump \vee \neg Big \vee Dump$

$\equiv True \vee Dump \equiv True$

Valid

7. $(Big \wedge Dump) \vee \neg Dump$

$\equiv (Big \vee \neg Dump) \wedge (Dump \vee \neg Dump)$

$\equiv (Big \vee \neg Dump) \wedge True$

$\equiv (Big \vee \neg Dump)$

Neither

Exercise 7.23

1.真值表如下：用 1 表示 True，用 0 表示 False

设 A= [(Food⇒Party)∨(Drinks⇒Party)]⇒[(Food∧Drinks)⇒Party]

Food	Drinks	Party	(Food⇒Party)	(Drinks⇒Party)	(Food∧Drinks)⇒Party	A
0	0	0	1	1	1	1
0	0	1	1	1	1	1

0	**1**	**0**	**1**	**0**	**1**	**1**
0	**1**	**1**	**1**	**1**	**1**	**1**
1	**0**	**0**	**0**	**1**	**1**	**1**
1	**0**	**1**	**1**	**1**	**1**	**1**
1	**1**	**0**	**0**	**0**	**0**	**1**
1	**1**	**1**	**1**	**1**	**1**	**1**

故，该语句是**有效的。**

2. 左右两边分别转换为 CNF

左边：(Food ⇒ Party) ∨ (Drinks ⇒ Party)

≡(¬Food ∨ Party) ∨ (¬Drinks ∨ Party)

≡(¬Food ∨ Party ∨ ¬Drinks ∨ Party)

≡(¬Food ∨ ¬Drinks ∨ Party)

右边：(Food ∧ Drinks) ⇒ Party

≡¬(Food ∧ Drinks) ∨ Party

≡(¬Food ∨ ¬Drinks) ∨ Party

≡(¬Food ∨ ¬Drinks ∨ Party)

解释：左右两边化为 CNF 后是相同的语句，设 B=(¬Food ∨ ¬Drinks ∨ Party)，所以原语句相当于 B⇒B，对于任意的 B 都是有效的

3.证明：

需证明 (Food⇒Party)∨(Drinks⇒Party) ∨ ¬ [(Food∧Drinks)⇒Party] 是不可满足的

（1）化为 CNF

(Food⇒Party)∨(Drinks⇒Party) ∨¬ [(Food∧Drinks)⇒Party]

≡(¬Food ∨ ¬Drinks ∨ Party) ∧ ¬ [¬Food ∨¬Drinks ∨ Party]

≡(¬Food ∨ ¬Drinks ∨ Party) ∧ Food ∧ Drinks ∧ ¬Party

（2）归结操作

子句集合为 clauses={¬Food ∨ ¬Drinks ∨ Party，Food，Drinks，¬Party }

子句归结后形成新子句集合 new={¬Drinks ∨ Party，¬Food ∨ Party，¬Food ∨ ¬Drinks }

更新子句集合 clauses={¬Drinks ∨ Party，¬Food ∨ Party，¬Food ∨ ¬Drinks }∪clauses

子句归结后形成新子句集合 new={ Food，Drinks，¬Party，¬Food，¬Drinks，Party…… }

更新子句集合 clauses=new∪clauses

子句归结过程中有：Food，¬Food 归结为空子句

所以语句(Food⇒Party)∨(Drinks⇒Party) ∨ ¬ [(Food∧Drinks)⇒Party] 是不可满足的，

即原语句是有效的。