**Variables: {A, B, C, D, E, F, G, H}**

**Premises:**

**1) (A⊕B) → C**

**2) (C ∧ D) → ¬E**

**3) (E ∨ F) ↔ G**

**4) (¬A ∧ B) → (D ∧ F)**

**5) (G ∧ H) → (A ∨ B)**

**6) (A ∧ ¬B) → (C ∧ ¬E)**

**7) (F⊕H) → (D ∨ E)**

**8) ¬(A ∧ B ∧ C)**

**9) (D ∧ E) → (¬G ∨ F)**

**10) (H ∨ G) → (A⊕B)**

**11) (¬E ∧ F) ↔ (C ∧ D)**

**12) (A ∨ C) → (B ∨ ¬F)**

**13) (G ∧ ¬H) → (E ∨ ¬A)**

**14) (B ∧ F) → (¬D ∨ H)**

**#15) (¬C ∨ D) → ¬H (original 6)**

**Conclusion: (G ∧ H) ∧ (A ∨ B) ∧ ¬E**

**immediately find a counterexample**

**1. 1) (A⊕B) → C=1**

**2. 1)** A=B=0

**4. 10) (H ∨ G) → (A⊕B) =1**

**5. H= 0 ∧ G=0**

**20. (G ∧ H) ∧ (A ∨ B) ∧ ¬E=0**

**12. 4) (¬A ∧ B) → (D ∧ F)**

**No redundancy: 10P because all var set: test rest redundant premises**

**May be different combination of constraint set, for this one following the**

**Process, it is the exactly only minimum set of constraint with same truth table**

**Conclusion if existing: prove sufficient, connection, and can create more new ones.**

**under one set of setting, they simultaneously hold. Just like thinking an IMO solution**

**11. 7) (F⊕H) → (D ∨ E)**

**7) (1⊕H) → 1=1**

**12. 3) (E ∨ F) ↔ G**

**3) (0 ∨ 1) ↔ G =1**

**15. 6) (A ∧ ¬B) → (C ∧ ¬E) =1**

**14. A=1∧ B =0 ∧ C=1**

**1. 1) (A⊕B) → C=1**

**4. 8) ¬(A ∧ B ∧ C) = 1**

**10.** D=1**∧** F=1**∧**E=0

**3. (A⊕B) =1∧** C=1

**2. 1) (A⊕B)=0**

**17. 14) (B ∧ F) → (¬D ∨ H)**

**13. G=1**

**20. 12) (A ∨ C) → (B ∨ ¬F)**

**14. A=0∧ B =1 ∧ C=1**

**8. D=0∧ (F=0 ∨E=1)** =1

**7. 11) (¬E ∧ F) ↔ (C ∧ D)**

**11) ((¬E ∧ F) ↔ D)=1**

**5. 10) (H ∨ G) → (A⊕B) =1**

**10) H → (A⊕B)=1**

**6. H=1**

**16. 6) (0 ∧ 0) → (1 ∧ 1) =1**

**18. 14) (1 ∧ 1) → (0 ∨ H)=1**

**20. 12) (0 ∨ 1) → (1 ∨ ¬F) =1**

**12) (0 ∨ 1) → (1 ∨0 )=1**

**20. (G ∧ H) ∧ (A ∨ B) ∧ ¬E**

**(1 ∧ 1) ∧ (0 ∨ 1) ∧ 1**

**6. H=0**

**12. 4) (¬A ∧ B) → 1**

**((¬A ∧ B) → 1)=1**

**8. 4) (¬A ∧ B) → 0**

**2.5. 4) (¬A ∧ B) → (D ∧ F) =1**

**Also found one counterexample: all 0s**

**2.14. 7) (F⊕H) → D**

**7) (0⊕0) → D=1**

**2.8. 3) (E ∨ F) ↔ G=1**

**2.10. 6) (A ∧ ¬B) → (C ∧ ¬E) =1**

**2.6. 8) ¬(A ∧ B ∧ C) = 1**

**2.9.** E=0**∧**F=0

**2.15. 12) (C→ 1) =1**

**2.** A=B=0

**2.4. 14) (B ∧ F) → (¬D ∨ H)=1**

**2.7. 12) (A ∨ C) → (B ∨ ¬F)**

**2.11. 11) (¬E ∧ F) ↔ (C ∧ D) =1**

**2.1. 10) (H ∨ G) → (A⊕B) =1**

**2.2. H= 0 ∧ G=0**

**2.13. C=0 ∧ D=0**

**2.12. 14) (1 ∧ 0) ↔ (C ∨ D)=1**

**2.3 (G ∧ H) ∧ (A ∨ B) ∧ ¬E=0**

**10. 4) (¬A ∧ B) → (D ∧ F)**

**((¬A ∧ B) → 1)=1**

**Old- 1 pathway**

**10. 7) (F⊕H) → (D ∨ E)**

**7) (1⊕H) → 1=1**

**11. 3) (E ∨ F) ↔ G**

**3) (0 ∨ 1) ↔ G =1**

**16. 6) (A ∧ ¬B) → (C ∧ ¬E) =1**

**14. A=1∧ B =0 ∧ C=1**

**1. 1) (A⊕B) → C=1**

**18. 8) ¬(A ∧ B ∧ C) = 1**

**9.** D=1**∧** F=1**∧**E=0

**3. (A⊕B) =1∧** C=1

**8.** D=0**∧** E=1

**2. 1) (**A=B=0)

**19. 14) (B ∧ F) → (¬D ∨ H)**

**12. G=1**

**20. 12) (A ∨ C) → (B ∨ ¬F)**

**15. A=0∧ B =1 ∧ C=1**

**7.** D=0**∧** F=0

**6. 11) (¬E ∧ F) ↔ (C ∧ D)**

**11) ((¬E ∧ F) ↔ D)=1**

**17. 6) (1 ∧ 1) → (1 ∧ 1) =1**

**4. 10) (H ∨ G) → (A⊕B)**

**10) H → (A⊕B)=1**

**5. H=1**

**18. 6) (0 ∧ 0) → (1 ∧ 1) =1**

**14) (0 → (¬D ∨ H)) = 1**

**21. 14) (1 ∧ 1) → (0 ∨ 1)=1**

**12) (1 ∨ 1) → (0 ∨ 0) =1**

**20. 12) (0 ∨ 1) → (1 ∨ ¬F) =1**

**12) (0 ∨ 1) → (1 ∨0 )=1**

**20. (G ∧ H) ∧ (A ∨ B) ∧ ¬E**

**(1 ∧ 1) ∧ (0 ∨ 1) ∧ 1**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Premise\Variable** | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** |
| **1) (A⊕B) → C (0+3)**  **(12)** | A=1 B=1 C=0  A=0 B=0 C=0  A=0 B=1 C=1  A=1 B=0 C=1 | A=1 B=1 C=0  A=0 B=0 C=0  A=0 B=1 C=1  A=1 B=0 C=1 | A=1 B=1 C=0  A=0 B=0 C=0  A=0 B=1 C=1  A=1 B=0 C=1 |  |  |  |  |  |
| **2) (C ∧ D) → ¬E (3)** |  |  | C=0 | D=0 | E=0 |  |  |  |
| **3) (E ∨ F) ↔ G (0+9) (7)** |  |  |  |  | E=1 G=1  E=0 F=0 G=0 | F=1 G=1  E=0 F=0 G=0 | E=1 G=1  F=1 G=1  E=0 F=0 G=0 |  |
| **4) (¬A ∧ B) → (D ∧ F) (0+5) (5)** | A=1 | B=0 |  | D=1 F=1 |  | D=1 F=1 |  |  |
| **5) (G ∧ H) → (A ∨ B) (4)** | A=1 B=1 | A=1 B=1 |  |  |  |  | G=0 | H=0 |
| **6) (A ∧ ¬B) → (C ∧ ¬E) (0+3) (4)** | A=0 | B=1 | C=1 E=0 |  | C=1 E=0 |  |  |  |
| **7) (F⊕H) → (D ∨ E) (0+3) (6)** |  |  |  | D=1 E=1 | D=1 E=1 | F=0 H=0  F=1 H=1 |  | F=0 H=0  F=1 H=1 |
| **8) ¬(A ∧ B ∧ C) (0+3) (3)** | A=0 | B=0 | C=0 |  |  |  |  |  |
| **9) (D ∧ E) → (¬G ∨ F) (4)** |  |  |  | D=0 | E=0 | F=1 | G=0 |  |
| **10) (H ∨ G) → (A⊕B) (6)** | A=0 B=1  A=1 B=0 | A=0 B=1  A=1 B=0 |  |  |  |  | H=0 G=0 | H=0 G=0 |
| **11) (¬E ∧ F) ↔ (C ∧ D) (0+2) (12)** |  |  | C=0 F=0  C=0 E=1  E=0 F=1 C=1 D=1 | D=0 F=0  D=0 E=1  E=0 F=1 C=1 D=1 | C=0 E=1  D=0 E=1  E=0 F=1 C=1 D=1 | C=0 F=0  D=0 F=0  E=0 F=1 C=1 D=1 |  |  |
| **12) (A ∨ C) → (B ∨ ¬F)**  **(0+1, 1+1) (4)** | A=0 C=0 | B=1 F=0 | A=0 C=0 |  |  | B=1 F=0 |  |  |
| **13) (G ∧ ¬H) → (E ∨ ¬A) (4)** | E=1 A=0 |  |  |  | E=1 A=0 |  | G=0 | H=1 |
| **14) (B ∧ F) → (¬D ∨ H) (4)** |  | B=0 |  | D=0 |  | F=0 |  | H=1 |
| **#count** | 12 | 12 | 11 | 8 | 10 | 11 | 7 | 6 |
| **(G ∧ H) ∧ (A ∨ B) ∧ ¬E** | A=1 B=0 G=1  E=0 H=1  A=0 B=1 G=1  E=0 H=1 |  |  |  |  |  |  |  |
| **# of Single constraint** | 3 | 4 | 2 | 3 | 2 | 2 | 3 | 3 |
| **Order** | 2 | 1 | 6 | 4 | 8 | 7 | 4 | 5 |
| **Estimated** | 0 | 0 | 0 | 0 |  |  |  |  |
| **=1** | 6, 8, | 4, | 1,11, 12 | 2, 9 |  |  |  | 14 |
| **Real** | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| ***#15) (¬C ∨ D) → ¬H*** |  |  | *C=1 D=0* | *C=1 D=0* |  |  |  | *H=0* |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Premise\Variable** | **A** | **B** | **C** | **D** | **E** | **F** | **G** | **H** |
| **1) (A⊕B) → C (0+3)** | ~~A=1 B=1 C=0~~  A=0 B=0 C=0  ~~A=0 B=1 C=1~~  ~~A=1 B=0 C=1~~ | ~~A=1 B=1 C=0~~  A=0 B=0 C=0  ~~A=0 B=1 C=1~~  ~~A=1 B=0 C=1~~ | ~~A=1 B=1 C=0~~  A=0 B=0 C=0  ~~A=0 B=1 C=1~~  ~~A=1 B=0 C=1~~ |  |  |  |  |  |
| **2) (C ∧ D) → ¬E** |  |  | ~~C=0~~ | D=0 | ~~E=0~~ |  |  |  |
| **3) (E ∨ F) ↔ G (0+9)** |  |  |  |  | E=1 G=1  E=0 F=0 G=0 | F=1 G=1  E=0 F=0 G=0 | E=1 G=1  F=1 G=1  E=0 F=0 G=0 |  |
| **4) (¬A ∧ B) → (D ∧ F) (0+5)** | ~~A=1~~ | B=0 |  | ~~D=1 F=1~~ |  | ~~D=1 F=1~~ |  |  |
| **5) (G ∧ H) → (A ∨ B)** | ~~A=1 B=1~~ | ~~A=1 B=1~~ |  |  |  |  | ~~G=0~~ | ~~H=0~~ |
| **6) (A ∧ ¬B) → (C ∧ ¬E) (0+3)** | A=0 | ~~B=1~~ | ~~C=1 E=0~~ |  | ~~C=1 E=0~~ |  |  |  |
| **7) (F⊕H) → (D ∨ E) (0+3)** |  |  |  | ~~D=1 E=1~~ | ~~D=1 E=1~~ | ~~F=0 H=0~~  F=1 H=1 |  | ~~F=0 H=0~~  F=1 H=1 |
| **8) ¬(A ∧ B ∧ C) (0+3)** | A=0 | ~~B=0~~ | ~~C=0~~ |  |  |  |  |  |
| **9) (D ∧ E) → (¬G ∨ F)** |  |  |  | D=0 | ~~E=0~~ | ~~F=1~~ | ~~G=0~~ |  |
| **10) (H ∨ G) → (A⊕B)** | ~~A=0 B=1~~  ~~A=1 B=0~~ | ~~A=0 B=1~~  ~~A=1 B=0~~ |  |  |  |  | ~~H=0 G=0~~ | ~~H=0 G=0~~ |
| **11)** **(¬E ∧ F) ↔ (C ∧ D) (0+2)** |  |  | C=0 F=0  C=0 E=1  E=0 F=1 C=1 D=1 | D=0 F=0  D=0 E=1  ~~E=0 F=1 C=1 D=1~~ | C=0 E=1  D=0 E=1  E=0 F=1 C=1 D=1 | C=0 F=0  D=0 F=0  E=0 F=1 C=1 D=1 |  |  |
| **12) (A ∨ C) → (B ∨ ¬F)**  **(0+1, 1+1)** | A=0 C=0 | ~~B=1 F=0~~ | A=0 C=0 |  |  | ~~B=1 F=0~~ |  |  |
| **13) (G ∧ ¬H) → (E ∨ ¬A)** | ~~E=1 A=0~~ |  |  |  | ~~E=1 A=0~~ |  | ~~G=0~~ | H=1 |
| **14) (B ∧ F) → (¬D ∨ H)** |  | ~~B=0~~ |  | ~~D=0~~ |  | ~~F=0~~ |  | H=1 |
| **#count** | 12 | 12 | 13 | 7 | 10 | 11 | 7 | 6 |
| **(G ∧ H) ∧ (A ∨ B) ∧ ¬E** | A=1 B=0 G=1  E=0 H=1  A=0 B=1 G=1  E=0 H=1 |  |  |  |  |  |  |  |
| **# of Single**  **constraint** | 3 | 4 | 2 | 3 | 2 | 2 | 3 | 3 |
| **Order** | 2 | 1 | 6 | 4 | 8 | 7 | 4 | 5 |
| **Estimated** | 0 | 0 | 0 | 0 |  |  |  |  |
| **=1** | 6, 8, | 4, | 1,11, 12 | 2, 9 |  |  |  | 14 |
| **Keep most constraints** |  |  |  |  |  |  |  | ~~13~~ |
| **Real** | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 |
| ***#15) (¬C ∨ D) → ¬H*** |  |  | *C=1 D=0* | *C=1 D=0* |  |  |  | *H=0* |

**Table 7. DCD Construction Processing**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Independent | | | | Estimated  Assignment | Cleanup Conflict including combinations | | Cleanup unnecessary constraints in other columns |
| Before Count | | After Count | |
| # of 0 | # of 1 | # of 0 | # of 1 | within column | Other columns |
| B | 3 | 1 |  |  | 0 | 1, 5, 6, 10, 12 | A(1, 5, 10), C1 F12 | A4 D4 F4 |
| A | 2 | 1 | 2 | 0 | 0 | 1, 4, 5, 10 | B1 C1 B10 | C6 E6 B8 C8 |
| H | 0+1 | 2 | 0+1 | 2 | 1 | 7, 10 | F7 G10 | G13 E13 A13 F14  B14 D14 |
| D | 3+1 | 0 | 2 | 0 | 0 | 4, 7, 11 | F4 E7 C11 E11 F11 | C2 E2 E9 F9 G9 |
| G | 3 | 0 | 1-co | 2-co | 0? |  |  |  |
| C | 2 | 0+1 | 5-co | 0 | 0 |  |  |  |
| F | 1 | 0 | 2-co | 3-co | ? |  |  |  |
| E | 2 | 0 | 2-co | 2-co |  |  |  |  |

**13. 3) D→(A∨C) = 1**

**Conclusion false and True**

**要么B=F（无论D），要么B=T并且D=T**

**7) (F⊕H) → (D ∨ E)**

**7. 3) (E ∨ F) ↔ G =1**

**2.1) 5) (G ∧ H) → (A ∨ B)=1**

**11. (A⊕B) =1**

**1. A~~=0, B=0~~ ~~C=0~~ D=0 H=1**

**1) 2) 4) 6) 8) 9) 12) 13) ~~14)=~~1**

**14. 5) (B∨C)→(D∨E) = 1**

**6. 13) = 14) =1**

**8. E=F=1**

**19. C=1**

**17. D =0**

**4. 10) (H ∨ G) → (A⊕B)**

**14) (B ∧ F) → (¬D ∨ H)**

**11) (¬E ∧ F) ↔ (C ∧ D)**

**3. G=0**

**13. A=0 ∧ B=1**

**25. (B ⊕ D) ∧¬(C∧G) =1**

**24. ¬ (C∧G) = 1**

**23.(B ⊕ D) ∧¬(C∧G) =0**

**9. H=1 ∧ G=1**

**5. H=0**

**18. B = 0**

**20. B⊕D=1**

**22. ¬B⊕D**

**21. ¬B⊕D**

**13. B=0 ∧ A=1**