Problems

1. Given the relation $R(A, B, C)$, compute a canonical cover based on the following functional dependencies:
   - $A \to B$
   - $C \to B$
   - $B \to A$
   - $C \to A$
2. Given the relation $R(A, B, C)$, compute a canonical cover based on the following functional dependencies:
   - $C \to B$
   - $B \to A$
   - $A \to C$
3. Given the relation $R(A, B, C)$, compute a canonical cover based on the following functional dependencies:
   - $C \to B$
   - $B \to A$
4. Given the relation $R(A, B, C)$, compute a canonical cover based on the following functional dependencies:
   - $B \to C$
   - $A \to C$
   - $C \to A$
5. Given the relation $R(A, B, C)$, compute a canonical cover based on the following functional dependencies:
   - $A \to B$
   - $C \to B$
   - $B \to C$
   - $B \to A$
6. Given the relation $R(A, B, C)$, compute a canonical cover based on the following functional dependencies:
   - $A \to B$
   - $C \to B$
   - $A \to C$
   - $C \to A$

7. Given the relation $R(A, B, C)$, compute a canonical cover based on the following functional dependencies:
   - $B \to C$
   - $A \to C$
8. Given the relation $R(A, B, C)$, compute a canonical cover based on the following functional dependencies:
   - $C \to A$
9. Given the relation $R(A, B, C)$, compute a canonical cover based on the following functional dependencies:
   - $C \to B$
   - $A \to C$
   - $C \to A$
10. Given the relation $R(A, B, C)$, compute a canonical cover based on the following functional dependencies:
    - $C \to B$
    - $B \to A$
11. Given the relation $R(A, B, C, D)$, compute a canonical cover based on the following functional dependencies:
    - $D \to B$
    - $C \to AB$
    - $A \to D$
    - $D \to C$
    - $CD \to B$
    - $A \to C$
12. Given the relation $R(A, B, C, D)$, compute a canonical cover based on the following functional dependencies:
    - $A \to B$
    - $A \to C$
    - $BD \to A$
    - $D \to A$
13. Given the relation $R(A, B, C, D)$, compute a canonical cover based on the following functional dependencies:
    - $AB \to C$

- $A \to C$
- $C \to D$

14. Given the relation $R(A, B, C, D)$, compute a canonical cover based on the following functional dependencies:
    - $C \to B$
    - $B \to D$
    - $A \to D$
15. Given the relation $R(A, B, C, D)$, compute a canonical cover based on the following functional dependencies:
    - $C \to AB$
    - $A \to D$
    - $D \to A$
    - $C \to B$
    - $AC \to D$
    - $AB \to C$
16. Given the relation $R(A, B, C, D)$, compute a canonical cover based on the following functional dependencies:
    - $C \to B$
    - $B \to C$
17. Given the relation $R(A, B, C, D)$, compute a canonical cover based on the following functional dependencies:
    - $B \to AC$
    - $B \to D$
    - $A \to D$
    - $B \to A$
18. Given the relation $R(A, B, C, D)$, compute a canonical cover based on the following functional dependencies:
    - $D \to B$
    - $D \to C$
    - $A \to D$
    - $A \to B$
    - $B \to A$
    - $A \to C$

19. Given the relation $R(A, B, C, D)$, compute a canonical cover based on the following functional dependencies:

    - $A \to D$
    - $D \to A$
    - $B \to D$
    - $C \to A$

20. Given the relation $R(A, B, C, D)$, compute a canonical cover based on the following functional dependencies:

    - $B \to AD$
    - $D \to B$
    - $B \to A$

21. Given the relation $R(A, B, C, D, E)$, compute a canonical cover based on the following functional dependencies:

    - $B \to ACE$
    - $A \to BDE$
    - $A \to E$
    - $AD \to CE$
    - $CE \to BD$
    - $B \to D$
    - $A \to B$
    - $C \to ABD$
    - $AE \to C$

22. Given the relation $R(A, B, C, D, E)$, compute a canonical cover based on the following functional dependencies:

    - $E \to B$
    - $B \to C$

23. Given the relation $R(A, B, C, D, E)$, compute a canonical cover based on the following functional dependencies:

    - $E \to B$
    - $A \to BDE$
    - $DE \to A$
    - $BD \to A$
    - $E \to AB$
    - $BE \to A$

- $D \rightarrow E$

24. Given the relation $R(A, B, C, D, E)$, compute a canonical cover based on the following functional dependencies:

    - $A \rightarrow BD$
    - $BD \rightarrow E$
    - $C \rightarrow AB$
    - $D \rightarrow A$
    - $CDE \rightarrow A$
    - $AB \rightarrow CD$

25. Given the relation $R(A, B, C, D, E)$, compute a canonical cover based on the following functional dependencies:

    - $E \rightarrow A$
    - $A \rightarrow B$
    - $E \rightarrow B$
    - $ABC \rightarrow E$

26. Given the relation $R(A, B, C, D, E)$, compute a canonical cover based on the following functional dependencies:

    - $B \rightarrow ACE$
    - $ABE \rightarrow C$
    - $DE \rightarrow C$
    - $C \rightarrow D$
    - $B \rightarrow E$
    - $AC \rightarrow D$
    - $E \rightarrow C$
    - $B \rightarrow C$
    - $A \rightarrow C$

27. Given the relation $R(A, B, C, D, E)$, compute a canonical cover based on the following functional dependencies:

    - $BC \rightarrow A$
    - $A \rightarrow D$
    - $B \rightarrow AE$

28. Given the relation $R(A, B, C, D, E)$, compute a canonical cover based on the following functional dependencies:

    - $E \rightarrow A$

- $BE \rightarrow A$
- $E \rightarrow C$
- $B \rightarrow AD$

29. Given the relation $R(A, B, C, D, E)$, compute a canonical cover based on the following functional dependencies:

    - $AC \rightarrow DE$
    - $BD \rightarrow AC$
    - $B \rightarrow E$
    - $C \rightarrow BDE$
    - $CE \rightarrow AD$

30. Given the relation $R(A, B, C, D, E)$, compute a canonical cover based on the following functional dependencies:

    - $ACD \rightarrow B$
    - $C \rightarrow BD$
    - $ABE \rightarrow D$
    - $DE \rightarrow A$
    - $AC \rightarrow BD$
    - $CE \rightarrow D$
    - $B \rightarrow C$

31. Given the relation $R(A, B, C, D, E, F)$, compute a canonical cover based on the following functional dependencies:

    - $F \rightarrow C$
    - $F \rightarrow A$
    - $E \rightarrow B$
    - $A \rightarrow E$
    - $AF \rightarrow C$
    - $A \rightarrow D$
    - $E \rightarrow C$
    - $B \rightarrow C$

32. Given the relation $R(A, B, C, D, E, F)$, compute a canonical cover based on the following functional dependencies:

    - $AF \rightarrow D$
    - $B \rightarrow F$
    - $BC \rightarrow DE$

- $F \to B$
- $E \to A$
- $C \to AF$

33. Given the relation $R(A, B, C, D, E, F)$, compute a canonical cover based on the following functional dependencies:

    - $A \to F$
    - $AB \to D$
    - $B \to CE$
    - $E \to F$
    - $B \to D$

34. Given the relation $R(A, B, C, D, E, F)$, compute a canonical cover based on the following functional dependencies:

    - $C \to BD$
    - $D \to B$
    - $BDE \to AF$
    - $CDE \to BF$
    - $BD \to C$
    - $AF \to DE$
    - $BF \to AD$
    - $BE \to A$
    - $A \to B$
    - $A \to CDF$
    - $DF \to E$

35. Given the relation $R(A, B, C, D, E, F)$, compute a canonical cover based on the following functional dependencies:

    - $C \to AD$
    - $F \to A$
    - $A \to BD$
    - $DF \to A$
    - $BC \to A$
    - $F \to BC$
    - $ABF \to DE$
    - $ACE \to D$

36. Given the relation $R(A, B, C, D, E, F)$, compute a canonical cover based on the following functional dependencies:

    - $B \to AC$
    - $B \to E$
    - $D \to E$
    - $D \to AC$

37. Given the relation $R(A, B, C, D, E, F)$, compute a canonical cover based on the following functional dependencies:

    - $DF \to A$
    - $BE \to ACF$
    - $A \to D$
    - $E \to D$
    - $D \to A$

38. Given the relation $R(A, B, C, D, E, F)$, compute a canonical cover based on the following functional dependencies:

    - $CE \to A$
    - $BD \to F$
    - $D \to B$
    - $B \to AF$
    - $F \to AD$
    - $DE \to CF$
    - $E \to D$
    - $ACD \to EF$
    - $F \to D$
    - $BF \to D$

39. Given the relation $R(A, B, C, D, E, F)$, compute a canonical cover based on the following functional dependencies:

    - $A \to EF$
    - $AEF \to C$
    - $B \to EF$

40. Given the relation $R(A, B, C, D, E, F)$, compute a canonical cover based on the following functional dependencies:

    - $F \to AD$
    - $D \to ACF$

- $F \to CDE$
- $D \to BE$
- $BD \to C$
- $C \to F$
- $F \to D$

41. Given the relation $R(A, B, C, D, E, F, G)$, compute a canonical cover based on the following functional dependencies:

    - $F \to A$
    - $AF \to BD$
    - $C \to E$
    - $E \to CD$
    - $AB \to G$
    - $B \to CG$
    - $ABE \to CFG$
    - $BD \to EF$

42. Given the relation $R(A, B, C, D, E, F, G)$, compute a canonical cover based on the following functional dependencies:

    - $A \to DE$
    - $CG \to A$
    - $CD \to E$
    - $B \to D$
    - $EG \to B$
    - $E \to A$
    - $FG \to D$
    - $DF \to AC$

43. Given the relation $R(A, B, C, D, E, F, G)$, compute a canonical cover based on the following functional dependencies:

    - $B \to AF$
    - $G \to C$
    - $BF \to C$
    - $FG \to A$
    - $BDE \to C$
    - $CG \to AF$
    - $AG \to DE$

- $E \to F$
- $E \to C$

44. Given the relation $R(A, B, C, D, E, F, G)$, compute a canonical cover based on the following functional dependencies:

    - $D \to AE$
    - $D \to C$
    - $BF \to A$
    - $CE \to D$
    - $E \to A$
    - $C \to DEG$
    - $G \to BC$

45. Given the relation $R(A, B, C, D, E, F, G)$, compute a canonical cover based on the following functional dependencies:

    - $BE \to D$
    - $EF \to G$
    - $BE \to G$
    - $G \to ACF$
    - $C \to G$
    - $F \to AG$
    - $EF \to ACG$
    - $G \to AC$
    - $ACG \to DE$
    - $BF \to G$
    - $BG \to AD$

46. Given the relation $R(A, B, C, D, E, F, G)$, compute a canonical cover based on the following functional dependencies:

    - $E \to CFG$
    - $G \to C$
    - $DF \to A$
    - $DF \to C$
    - $CDG \to E$
    - $E \to A$
    - $G \to F$

47. Given the relation $R(A, B, C, D, E, F, G)$, compute a canonical cover based on the following functional dependencies:

    - $C \rightarrow AD$
    - $E \rightarrow B$
    - $A \rightarrow C$

48. Given the relation $R(A, B, C, D, E, F, G)$, compute a canonical cover based on the following functional dependencies:

    - $E \rightarrow ADF$
    - $B \rightarrow CDF$
    - $CD \rightarrow AF$

49. Given the relation $R(A, B, C, D, E, F, G)$, compute a canonical cover based on the following functional dependencies:

    - $DFG \rightarrow CE$
    - $F \rightarrow G$
    - $A \rightarrow F$
    - $B \rightarrow C$
    - $A \rightarrow B$
    - $CDG \rightarrow E$
    - $E \rightarrow F$
    - $E \rightarrow BFG$
    - $AG \rightarrow C$
    - $F \rightarrow B$
    - $D \rightarrow ABG$

50. Given the relation $R(A, B, C, D, E, F, G)$, compute a canonical cover based on the following functional dependencies:

    - $A \rightarrow BDF$
    - $A \rightarrow BE$
    - $BEF \rightarrow ACG$
    - $DE \rightarrow B$

Solutions

1. **Solution:**$C \to B$ $A \to B$ $B \to A$
   Example resolution:
   - Merging $C \to A$ and $C \to B$ into $C \to AB$
   - Removed extraneous component: $C \to AB$ gives $C \to B$
2. **Solution:**$C \to B$ $B \to A$ $A \to C$ - There is nothing to do
3. **Solution:**$C \to B$ $B \to A$ - There is nothing to do
4. **Solution:**$B \to C$ $A \to C$ $C \to A$ - There is nothing to do
5. **Solution:**$B \to AC$ $A \to B$ $C \to B$
   Example resolution:
   - Merging $B \to A$ and $B \to C$ into $B \to AC$
6. **Solution:**$C \to A$ $A \to BC$
   Example resolution:
   - Merging $A \to C$ and $A \to B$ into $A \to BC$
   - Merging $C \to A$ and $C \to B$ into $C \to AB$
   - Removed extraneous component: $C \to AB$ gives $C \to A$
7. **Solution:**$B \to C$ $A \to C$ - There is nothing to do
8. **Solution:**$C \to A$ - There is nothing to do
9. **Solution:**$C \to AB$ $A \to C$
   Example resolution:
   - Merging $C \to A$ and $C \to B$ into $C \to AB$
10. **Solution:**$C \to B$ $B \to A$ - There is nothing to do
11. **Solution:**$D \to BC$ $A \to D$ $C \to A$
    Example resolution:
    - Merging $D \to C$ and $D \to B$ into $D \to BC$
    - Merging $A \to C$ and $A \to D$ into $A \to CD$
    - Removed extraneous component: $A \to CD$ gives $A \to D$
    - Removed extraneous component: $D \to BC$ gives $D \to C$
    - Removed extraneous component: $C \to AB$ gives $C \to A$
    - Removed extraneous component: $CD \to B$ gives $D \to B$
    - Merging $D \to B$ and $D \to C$ into $D \to BC$

12. **Solution:**$D \to A$ $A \to BC$
Example resolution:
    - Merging $A \to C$ and $A \to B$ into $A \to BC$
    - Removed extraneous component: $BD \to A$ gives $D \to A$
    - Merging $D \to A$ and $D \to A$ into $D \to A$
13. **Solution:**$A \to C$ $C \to D$
Example resolution:
    - Removed extraneous component: $AB \to C$ gives $A \to C$
    - Merging $A \to C$ and $A \to C$ into $A \to C$
14. **Solution:**$C \to B$ $B \to D$ $A \to D$ - There is nothing to do
15. **Solution:**$C \to BD$ $A \to D$ $D \to A$ $AB \to C$
Example resolution:
    - Merging $C \to B$ and $C \to AB$ into $C \to AB$
    - Removed extraneous component: $AC \to D$ gives $C \to D$
    - Merging $C \to D$ and $C \to AB$ into $C \to ABD$
    - Removed extraneous component: $C \to ABD$ gives $C \to BD$
16. **Solution:**$C \to B$ $B \to C$ - There is nothing to do
17. **Solution:**$B \to AC$ $A \to D$
Example resolution:
    - Merging $B \to D$ and $B \to AC$ into $B \to ACD$
    - Merging $B \to A$ and $B \to ACD$ into $B \to ACD$
    - Removed extraneous component: $B \to ACD$ gives $B \to AC$
18. **Solution:**$A \to D$ $D \to BC$ $B \to A$
Example resolution:
    - Merging $D \to C$ and $D \to B$ into $D \to BC$
    - Merging $A \to B$ and $A \to D$ into $A \to BD$
    - Merging $A \to C$ and $A \to BD$ into $A \to BCD$
    - Removed extraneous component: $A \to BCD$ gives $A \to CD$
    - Removed extraneous component: $A \to CD$ gives $A \to D$
19. **Solution:**$A \to D$ $D \to A$ $B \to D$ $C \to A$ - There is nothing to do
20. **Solution:**$B \to AD$ $D \to B$
Example resolution:
    - Merging $B \to A$ and $B \to AD$ into $B \to AD$

21. **Solution:**$A \to CE\ C \to ABD\ B \to C$
Example resolution:

- Merging $A \to E$ and $A \to BDE$ into $A \to BDE$
- Merging $B \to D$ and $B \to ACE$ into $B \to ACDE$
- Merging $A \to B$ and $A \to BDE$ into $A \to BDE$
- Removed extraneous component: $A \to BDE$ gives $A \to DE$
- Removed extraneous component: $A \to DE$ gives $A \to E$
- Removed extraneous component: $B \to ACDE$ gives $B \to CDE$
- Removed extraneous component: $B \to CDE$ gives $B \to CE$
- Removed extraneous component: $B \to CE$ gives $B \to C$
- Removed extraneous component: $AD \to CE$ gives $A \to CE$
- Merging $A \to CE$ and $A \to E$ into $A \to CE$
- Removed extraneous component: $A \to CE$ gives $A \to E$
- Removed extraneous component: $CE \to BD$ gives $C \to BD$
- Merging $C \to ABD$ and $C \to BD$ into $C \to ABD$
- Removed extraneous component: $AE \to C$ gives $A \to C$
- Merging $A \to C$ and $A \to E$ into $A \to CE$

22. **Solution:**$E \to B\ B \to C$ - There is nothing to do

23. **Solution:**$E \to AB\ D \to E\ A \to D$
Example resolution:

- Merging $E \to AB$ and $E \to B$ into $E \to AB$
- Removed extraneous component: $E \to AB$ gives $E \to B$
- Removed extraneous component: $A \to BDE$ gives $A \to DE$
- Removed extraneous component: $A \to DE$ gives $A \to D$
- Removed extraneous component: $DE \to A$ gives $E \to A$
- Merging $E \to A$ and $E \to B$ into $E \to AB$
- Removed extraneous component: $E \to AB$ gives $E \to B$
- Removed extraneous component: $BD \to A$ gives $D \to A$
- Merging $D \to E$ and $D \to A$ into $D \to AE$
- Removed extraneous component: $D \to AE$ gives $D \to E$
- Removed extraneous component: $BE \to A$ gives $E \to A$
- Merging $E \to A$ and $E \to B$ into $E \to AB$

24. **Solution:**$A \to BCD\ D \to AE\ C \to A$
Example resolution:

- Removed extraneous component: $A \to BD$ gives $A \to B$
- Removed extraneous component: $BD \to E$ gives $D \to E$
- Merging $D \to A$ and $D \to E$ into $D \to AE$
- Removed extraneous component: $C \to AB$ gives $C \to A$
- Removed extraneous component: $CDE \to A$ gives $DE \to A$
- Removed extraneous component: $D \to AE$ gives $D \to E$
- Removed extraneous component: $DE \to A$ gives $D \to A$
- Merging $D \to A$ and $D \to E$ into $D \to AE$
- Removed extraneous component: $AB \to CD$ gives $A \to CD$
- Merging $A \to CD$ and $A \to B$ into $A \to BCD$

25. **Solution:**$E \to A$ $A \to B$ $AC \to E$
Example resolution:

- Merging $E \to B$ and $E \to A$ into $E \to AB$
- Removed extraneous component: $E \to AB$ gives $E \to A$
- Removed extraneous component: $ABC \to E$ gives $AC \to E$

26. **Solution:**$C \to D$ $E \to C$ $B \to AE$ $A \to C$
Example resolution:

- Merging $B \to E$ and $B \to ACE$ into $B \to ACE$
- Merging $B \to C$ and $B \to ACE$ into $B \to ACE$
- Removed extraneous component: $B \to ACE$ gives $B \to AE$
- Removed extraneous component: $ABE \to C$ gives $BE \to C$
- Removed extraneous component: $BE \to C$ gives $E \to C$
- Merging $E \to C$ and $E \to C$ into $E \to C$
- Removed extraneous component: $DE \to C$ gives $E \to C$
- Merging $E \to C$ and $E \to C$ into $E \to C$
- Removed extraneous component: $AC \to D$ gives $C \to D$
- Merging $C \to D$ and $C \to D$ into $C \to D$

27. **Solution:**$B \to AE$ $A \to D$
Example resolution:

- Removed extraneous component: $BC \to A$ gives $B \to A$
- Merging $B \to AE$ and $B \to A$ into $B \to AE$

28. **Solution:**$E \to AC$ $B \to AD$
Example resolution:

- Merging $E \to C$ and $E \to A$ into $E \to AC$

- Removed extraneous component: $BE \to A$ gives $E \to A$
- Merging $E \to A$ and $E \to AC$ into $E \to AC$

29. **Solution:**$C \to ABD$ $BD \to C$ $B \to E$
Example resolution:

- Removed extraneous component: $AC \to DE$ gives $C \to DE$
- Merging $C \to BDE$ and $C \to DE$ into $C \to BDE$
- Removed extraneous component: $C \to BDE$ gives $C \to BE$
- Removed extraneous component: $C \to BE$ gives $C \to B$
- Removed extraneous component: $BD \to AC$ gives $BD \to C$
- Removed extraneous component: $CE \to AD$ gives $C \to AD$
- Merging $C \to AD$ and $C \to B$ into $C \to ABD$

30. **Solution:**$C \to BD$ $B \to C$ $DE \to A$
Example resolution:

- Removed extraneous component: $ACD \to B$ gives $CD \to B$
- Removed extraneous component: $CD \to B$ gives $C \to B$
- Merging $C \to BD$ and $C \to B$ into $C \to BD$
- Removed extraneous component: $ABE \to D$ gives $BE \to D$
- Removed extraneous component: $BE \to D$ gives $B \to D$
- Merging $B \to C$ and $B \to D$ into $B \to CD$
- Removed extraneous component: $B \to CD$ gives $B \to C$
- Removed extraneous component: $AC \to BD$ gives $C \to BD$
- Merging $C \to BD$ and $C \to BD$ into $C \to BD$
- Removed extraneous component: $CE \to D$ gives $C \to D$
- Merging $C \to D$ and $C \to BD$ into $C \to BD$

31. **Solution:**$F \to A$ $E \to B$ $A \to DE$ $B \to C$
Example resolution:

- Merging $F \to A$ and $F \to C$ into $F \to AC$
- Merging $A \to D$ and $A \to E$ into $A \to DE$
- Merging $E \to C$ and $E \to B$ into $E \to BC$
- Removed extraneous component: $E \to BC$ gives $E \to B$
- Removed extraneous component: $F \to AC$ gives $F \to A$
- Removed extraneous component: $AF \to C$ gives $F \to C$
- Merging $F \to C$ and $F \to A$ into $F \to AC$
- Removed extraneous component: $F \to AC$ gives $F \to A$

32. **Solution:**$C \to EF\ AF \to D\ B \to F\ F \to B\ E \to A$
Example resolution:

- Removed extraneous component: $BC \to DE$ gives $C \to DE$
- Merging $C \to AF$ and $C \to DE$ into $C \to ADEF$
- Removed extraneous component: $C \to ADEF$ gives $C \to DEF$
- Removed extraneous component: $C \to DEF$ gives $C \to EF$

33. **Solution:**$B \to CDE\ A \to F\ E \to F$
Example resolution:

- Merging $B \to D$ and $B \to CE$ into $B \to CDE$
- Removed extraneous component: $AB \to D$ gives $B \to D$
- Merging $B \to D$ and $B \to CDE$ into $B \to CDE$

34. **Solution:**$A \to DF\ D \to BC\ C \to D\ BF \to D\ BE \to A\ DF \to E$
Example resolution:

- Merging $A \to CDF$ and $A \to B$ into $A \to BCDF$
- Removed extraneous component: $A \to BCDF$ gives $A \to CDF$
- Removed extraneous component: $A \to CDF$ gives $A \to DF$
- Removed extraneous component: $A \to DF$ gives $A \to F$
- Removed extraneous component: $C \to BD$ gives $C \to D$
- Removed extraneous component: $BDE \to AF$ gives $DE \to AF$
- Removed extraneous component: $DE \to AF$ gives $DE \to F$
- Removed extraneous component: $DE \to F$ gives $DE \to$
- Removed extraneous component: $DE \to$ gives $E \to$
- Removed extraneous component: $E \to$ gives $\to$
- Removed extraneous component: $CDE \to BF$ gives $DE \to BF$
- Removed extraneous component: $DE \to BF$ gives $DE \to F$
- Removed extraneous component: $DE \to F$ gives $DE \to$
- Removed extraneous component: $DE \to$ gives $E \to$
- Removed extraneous component: $E \to$ gives $\to$
- Removed extraneous component: $BD \to C$ gives $D \to C$
- Merging $D \to C$ and $D \to B$ into $D \to BC$
- Removed extraneous component: $AF \to DE$ gives $A \to DE$
- Merging $A \to DE$ and $A \to F$ into $A \to DEF$
- Removed extraneous component: $A \to DEF$ gives $A \to DF$
- Removed extraneous component: $BF \to AD$ gives $BF \to D$

35. **Solution:**$C \to A$ $F \to CE$ $A \to BD$
Example resolution:

- Merging $F \to BC$ and $F \to A$ into $F \to ABC$
- Removed extraneous component: $F \to ABC$ gives $F \to BC$
- Removed extraneous component: $F \to BC$ gives $F \to C$
- Removed extraneous component: $C \to AD$ gives $C \to A$
- Removed extraneous component: $DF \to A$ gives $F \to A$
- Merging $F \to A$ and $F \to C$ into $F \to AC$
- Removed extraneous component: $F \to AC$ gives $F \to C$
- Removed extraneous component: $BC \to A$ gives $C \to A$
- Merging $C \to A$ and $C \to A$ into $C \to A$
- Removed extraneous component: $ABF \to DE$ gives $BF \to DE$
- Removed extraneous component: $BF \to DE$ gives $F \to DE$
- Merging $F \to DE$ and $F \to C$ into $F \to CDE$
- Removed extraneous component: $F \to CDE$ gives $F \to CE$
- Removed extraneous component: $ACE \to D$ gives $CE \to D$
- Removed extraneous component: $CE \to D$ gives $C \to D$
- Merging $C \to D$ and $C \to A$ into $C \to AD$
- Removed extraneous component: $C \to AD$ gives $C \to A$

36. **Solution:**$D \to ACE$ $B \to ACE$
Example resolution:

- Merging $B \to E$ and $B \to AC$ into $B \to ACE$
- Merging $D \to AC$ and $D \to E$ into $D \to ACE$

37. **Solution:**$D \to A$ $BE \to CF$ $A \to D$ $E \to D$
Example resolution:

- Removed extraneous component: $DF \to A$ gives $D \to A$
- Merging $D \to A$ and $D \to A$ into $D \to A$
- Removed extraneous component: $BE \to ACF$ gives $BE \to CF$

38. **Solution:**$F \to D$ $E \to CF$ $D \to B$ $B \to AF$ $CD \to E$
Example resolution:

- Merging $F \to D$ and $F \to AD$ into $F \to AD$
- Removed extraneous component: $F \to AD$ gives $F \to D$
- Removed extraneous component: $CE \to A$ gives $E \to A$
- Merging $E \to D$ and $E \to A$ into $E \to AD$

- Removed extraneous component: $E \to AD$ gives $E \to D$
- Removed extraneous component: $BD \to F$ gives $D \to F$
- Merging $D \to B$ and $D \to F$ into $D \to BF$
- Removed extraneous component: $D \to BF$ gives $D \to B$
- Removed extraneous component: $DE \to CF$ gives $E \to CF$
- Merging $E \to CF$ and $E \to D$ into $E \to CDF$
- Removed extraneous component: $E \to CDF$ gives $E \to CF$
- Removed extraneous component: $ACD \to EF$ gives $CD \to EF$
- Removed extraneous component: $CD \to EF$ gives $CD \to E$
- Removed extraneous component: $BF \to D$ gives $F \to D$
- Merging $F \to D$ and $F \to D$ into $F \to D$

39. **Solution:**$A \to CEF$ $B \to EF$
Example resolution:

- Removed extraneous component: $AEF \to C$ gives $AF \to C$
- Removed extraneous component: $AF \to C$ gives $A \to C$
- Merging $A \to C$ and $A \to EF$ into $A \to CEF$

40. **Solution:**$D \to ABCE$ $F \to D$ $C \to F$
Example resolution:

- Merging $F \to CDE$ and $F \to AD$ into $F \to ACDE$
- Merging $D \to BE$ and $D \to ACF$ into $D \to ABCEF$
- Merging $F \to D$ and $F \to ACDE$ into $F \to ACDE$
- Removed extraneous component: $F \to ACDE$ gives $F \to CDE$
- Removed extraneous component: $F \to CDE$ gives $F \to DE$
- Removed extraneous component: $F \to DE$ gives $F \to D$
- Removed extraneous component: $D \to ABCEF$ gives $D \to ABEF$
- Removed extraneous component: $D \to ABEF$ gives $D \to ABE$
- Removed extraneous component: $BD \to C$ gives $D \to C$
- Merging $D \to C$ and $D \to ABE$ into $D \to ABCE$

41. **Solution:**$B \to EFG$ $F \to AB$ $C \to E$ $E \to CD$
Example resolution:

- Removed extraneous component: $AF \to BD$ gives $F \to BD$
- Merging $F \to BD$ and $F \to A$ into $F \to ABD$
- Removed extraneous component: $F \to ABD$ gives $F \to AB$
- Removed extraneous component: $AB \to G$ gives $B \to G$

- Merging $B \to CG$ and $B \to G$ into $B \to CG$
- Removed extraneous component: $B \to CG$ gives $B \to C$
- Removed extraneous component: $ABE \to CFG$ gives $BE \to CFG$
- Removed extraneous component: $BE \to CFG$ gives $B \to CFG$
- Merging $B \to CFG$ and $B \to C$ into $B \to CFG$
- Removed extraneous component: $B \to CFG$ gives $B \to CG$
- Removed extraneous component: $BD \to EF$ gives $B \to EF$
- Merging $B \to EF$ and $B \to CG$ into $B \to CEFG$
- Removed extraneous component: $B \to CEFG$ gives $B \to EFG$

42. **Solution:**$A \to DE\ CG \to A\ CD \to E\ B \to D\ EG \to B\ E \to A\ FG \to D\ DF \to C$
Example resolution:

- Removed extraneous component: $DF \to AC$ gives $DF \to C$

43. **Solution:**$G \to ADE\ E \to CF\ B \to ACF$
Example resolution:

- Merging $E \to C$ and $E \to F$ into $E \to CF$
- Removed extraneous component: $BF \to C$ gives $B \to C$
- Merging $B \to C$ and $B \to AF$ into $B \to ACF$
- Removed extraneous component: $FG \to A$ gives $G \to A$
- Merging $G \to A$ and $G \to C$ into $G \to AC$
- Removed extraneous component: $G \to AC$ gives $G \to C$
- Removed extraneous component: $BDE \to C$ gives $DE \to C$
- Removed extraneous component: $DE \to C$ gives $E \to C$
- Merging $E \to C$ and $E \to CF$ into $E \to CF$
- Removed extraneous component: $CG \to AF$ gives $G \to AF$
- Merging $G \to AF$ and $G \to C$ into $G \to ACF$
- Removed extraneous component: $G \to ACF$ gives $G \to AF$
- Removed extraneous component: $G \to AF$ gives $G \to A$
- Removed extraneous component: $AG \to DE$ gives $G \to DE$
- Merging $G \to DE$ and $G \to A$ into $G \to ADE$

44. **Solution:**$C \to DEG\ D \to C\ BF \to A\ E \to A\ G \to BC$
Example resolution:

- Merging $D \to C$ and $D \to AE$ into $D \to ACE$
- Removed extraneous component: $D \to ACE$ gives $D \to CE$

- Removed extraneous component: $D \to CE$ gives $D \to C$
- Removed extraneous component: $CE \to D$ gives $C \to D$
- Merging $C \to DEG$ and $C \to D$ into $C \to DEG$

45. **Solution:**$G \to CDEF$ $F \to AG$ $BE \to G$ $C \to G$
Example resolution:

- Merging $BE \to G$ and $BE \to D$ into $BE \to DG$
- Merging $EF \to ACG$ and $EF \to G$ into $EF \to ACG$
- Merging $G \to AC$ and $G \to ACF$ into $G \to ACF$
- Removed extraneous component: $G \to ACF$ gives $G \to CF$
- Removed extraneous component: $EF \to ACG$ gives $F \to ACG$
- Merging $F \to AG$ and $F \to ACG$ into $F \to ACG$
- Removed extraneous component: $F \to ACG$ gives $F \to AG$
- Removed extraneous component: $BE \to DG$ gives $BE \to G$
- Removed extraneous component: $ACG \to DE$ gives $CG \to DE$
- Removed extraneous component: $CG \to DE$ gives $G \to DE$
- Merging $G \to DE$ and $G \to CF$ into $G \to CDEF$
- Removed extraneous component: $BF \to G$ gives $F \to G$
- Merging $F \to G$ and $F \to AG$ into $F \to AG$
- Removed extraneous component: $BG \to AD$ gives $G \to AD$
- Merging $G \to AD$ and $G \to CDEF$ into $G \to ACDEF$
- Removed extraneous component: $G \to ACDEF$ gives $G \to CDEF$

46. **Solution:**$G \to CF$ $E \to AG$ $DF \to AC$ $DG \to E$
Example resolution:

- Merging $DF \to C$ and $DF \to A$ into $DF \to AC$
- Merging $E \to A$ and $E \to CFG$ into $E \to ACFG$
- Merging $G \to F$ and $G \to C$ into $G \to CF$
- Removed extraneous component: $E \to ACFG$ gives $E \to AFG$
- Removed extraneous component: $E \to AFG$ gives $E \to AG$
- Removed extraneous component: $CDG \to E$ gives $DG \to E$

47. **Solution:**$C \to AD$ $E \to B$ $A \to C$ - There is nothing to do

48. **Solution:**$E \to ADF$ $B \to CD$ $CD \to AF$
Example resolution:

- Removed extraneous component: $B \to CDF$ gives $B \to CD$

49. **Solution:**$A \to F\ D \to AE\ F \to BG\ E \to F\ B \to C$
Example resolution:

- Merging $A \to B$ and $A \to F$ into $A \to BF$
- Merging $E \to BFG$ and $E \to F$ into $E \to BFG$
- Merging $F \to B$ and $F \to G$ into $F \to BG$
- Removed extraneous component: $E \to BFG$ gives $E \to FG$
- Removed extraneous component: $E \to FG$ gives $E \to F$
- Removed extraneous component: $A \to BF$ gives $A \to F$
- Removed extraneous component: $DFG \to CE$ gives $DG \to CE$
- Removed extraneous component: $DG \to CE$ gives $D \to CE$
- Merging $D \to ABG$ and $D \to CE$ into $D \to ABCEG$
- Removed extraneous component: $D \to ABCEG$ gives $D \to ACEG$
- Removed extraneous component: $D \to ACEG$ gives $D \to AEG$
- Removed extraneous component: $D \to AEG$ gives $D \to AG$
- Removed extraneous component: $D \to AG$ gives $D \to A$
- Removed extraneous component: $CDG \to E$ gives $DG \to E$
- Removed extraneous component: $DG \to E$ gives $D \to E$
- Merging $D \to E$ and $D \to A$ into $D \to AE$
- Removed extraneous component: $AG \to C$ gives $A \to C$
- Merging $A \to C$ and $A \to F$ into $A \to CF$
- Removed extraneous component: $A \to CF$ gives $A \to F$

50. **Solution:**$A \to DEF\ BEF \to ACG\ DE \to B$
Example resolution:

- Merging $A \to BE$ and $A \to BDF$ into $A \to BDEF$
- Removed extraneous component: $A \to BDEF$ gives $A \to DEF$