**Conditionals Extra Practice Drill #4**

*Instructions: Symbolize the following rules. Be sure to symbolize contrapositives as well.*

*Each rule includes an indication as to what kind of game it is associated with. Ordering games consist solely of ordered spots. Binary games consist solely of two groups, one of which should be considered the "yes" group, with the other as the "no" group. Grouping games consist of more than two groups. Hybrid games consist of both ordered spots and an excluded (or "no") group.*

1. If F is lifted, then so is G. (Binary game)

2. If H maintains the garden, both J and K maintain the museum. (Binary game)

3. If L is named to the Bamforth chair, then M is named to the Duncan chair. (Grouping game)

4. Of the three desserts N, O, and P, exactly two are offered. (Binary game)

5. If the child picks Q, then she picks both R and S. (Binary game)

6. Either T or U or both are posted. (Binary game)

7. If she protects one or more V, then she protects at least one W. (Binary game)

8. If X is assigned to cabin 2, Y is assigned to cabin 3. (Grouping game)

9. Either F or G, but not both, is blue. (Grouping game)

10. If H is purchased, then neither J nor K can be purchased. (Binary game)

11. If L is qualified, both M and N are also qualified. (Binary game)

12. If O is on, then P and T are off. (Binary game)

13. If Q sits immediately next to R, Q does not sit immediately next to S. (Ordering game)

14. If U is removed, then V is also removed but W is not. (Binary game)

15. If Y is added to bin 1, Z must also be added to bin 1. (Grouping game)

16. Whenever either F or G sails, H cannot sail. (Binary game)

17. If J is recommended for a task, either K or L must be recommended for that task. (Grouping game)

18. Either M or N must be searched, but M and N cannot both be searched. (Binary game)

19. If O is at Drexel, then both P and Q are at Crayall. (Grouping game)

20. If R is taught on day 2, S is taught on day 4. (Ordering game)

**Answers:**

1. $F \rightarrow G$
   $\sim G \rightarrow \sim F$

2. $H \rightarrow \sim J$ AND $\sim K$
   K OR J $\rightarrow \sim H$
   (Assuming that the garden is the "yes" group)

3. $L_B \rightarrow M_D$
   $\sim M_D \rightarrow \sim L_B$

4. The best way to symbolize this is to reserve two spots in the "offered" group and one in the "not offered" group for N, O, and P. You could try to construct a trio of conditionals, but this is less intuitive and gets messy quickly:
   N AND O $\rightarrow \sim P$
   N AND P $\rightarrow \sim O$
   O AND P $\rightarrow \sim N$
   $\sim N \rightarrow$ O AND P
   $\sim O \rightarrow$ N AND P
   $\sim P \rightarrow$ N AND O

5. $Q \rightarrow R$ AND S
   $\sim R$ OR $\sim S \rightarrow \sim Q$

6. $\sim U \rightarrow T$
   $\sim T \rightarrow U$

7. $V \rightarrow W$
   $\sim W \rightarrow \sim V$

8. $X_2 \rightarrow Y_3$
   $\sim Y_3 \rightarrow \sim X_2$

9. $F_B \rightarrow \sim G_B$
   $G_B \rightarrow \sim F_B$
   $\sim G_B \rightarrow F_B$
   $\sim F_B \rightarrow G_B$
   (An easier way to do this would be to put a reserved spot for F or G in the blue group, and make a note, perhaps with an antiblock, that they cannot be together.)

10. $H \rightarrow \sim J$ AND $\sim K$
    J OR K $\rightarrow \sim H$

11. $L \rightarrow M$ AND N
    $\sim M$ OR $\sim N \rightarrow \sim L$

12. $O \rightarrow \sim P$ AND $\sim T$
    P OR T $\rightarrow \sim O$

13. (QR) $\rightarrow$ ~~(QS)~~
    (QS) $\rightarrow$ ~~(QR)~~
    (Another way to do this would be to construct a symbol showing that Q cannot sit between R and S: ~~(R Q S)~~

14. $U \rightarrow V$ AND $\sim W$
    W OR $\sim V \rightarrow \sim U$

15. $Y_1 \rightarrow Z_1$
    $\sim Z_1 \rightarrow \sim Y_1$

16. F OR G $\rightarrow \sim H$
    $H \rightarrow \sim F$ AND $\sim G$

17. $J \rightarrow K$ OR L
    $\sim L$ AND $\sim K \rightarrow \sim J$
    (These symbols apply to every group.)

18. $M \rightarrow \sim N$
    $N \rightarrow \sim M$
    $\sim M \rightarrow N$
    $\sim N \rightarrow M$
    (A better symbol would be a barbell across the two groups or an antiblock showing that M and N must be separated)

19. $O_D \rightarrow P_C$ AND $Q_C$
    $\sim P_C$ OR $\sim Q_C \rightarrow \sim O_D$

20. $R_2 \rightarrow S_4$
    $\sim S_4 \rightarrow \sim R_2$