PRACTICE EXERCISES

1. Suppose p is the statement 'You eat carrots' and q is the statement 'You have good eyesight.' Select the correct statement corresponding to the symbols \( \sim(p \rightarrow q) \).

A. You don't eat carrots or you have good eyesight.
B. If you don't eat carrots then you have good eyesight.
C. It is not the case that if you eat carrots then you have good eyesight.
D. It is not the case that either you eat carrots or you have good eyesight.

2. Suppose p is the statement 'I pass my math course' and q is the statement 'I will change my major to nuclear physics.' Select the correct statement corresponding to the symbols \( \sim p \rightarrow q \).

A. It is not the case that if I pass my math course then I will change my major to nuclear physics.
B. It is not the case that either I pass my math course or I will change my major to nuclear physics.
C. I don't pass my math course and I will change my major to nuclear physics.
D. None of these.

3. Suppose p is the statement 'You get a speeding ticket' and q is the statement 'Your insurance rate goes up.' Select the correct symbolization for the statement 'If your insurance rate doesn't go up then you don't get a speeding ticket'.

A. \( \sim p \rightarrow \sim q \)
B. \( \sim q \land \sim p \)
C. \( \sim q \rightarrow \sim p \)
D. None of these.

4. Suppose p is true, q is false, s is true. Find the truth value of \((\sim s \land \sim p) \rightarrow (\sim q \lor s)\).

5. Suppose p is true, q is true, s is false. Find the truth value of \(\sim[\sim(p \lor q) \rightarrow \sim(p \land q)]\).

6. Suppose p is false, q is true, r is true, s is false. Find the truth value of \(\sim(p \lor q) \rightarrow (r \rightarrow s)\).

7. Suppose p is false, q is true, s is true. Find the truth value of \(\sim(p \rightarrow q) \rightarrow (q \lor s)\).

8. Suppose p is false, q is true, r is true, s is true. Find the truth value of \((p \rightarrow q) \lor (r \land \sim s)\).

9. Suppose p is false, q is true, s is false. Find the truth value of \(\sim[\sim(p \land q) \rightarrow \sim q]\).

10-18: Make a truth table for the given statement.

10. \(\sim(p \lor q) \rightarrow (\sim(p \lor q) \lor (\sim q \rightarrow s))\)
11. \((p \land q) \rightarrow (\sim p \rightarrow q)\)
12. \(\sim[\sim(p \lor q) \rightarrow p]\)
13. \((p \land q) \rightarrow (p \lor q)\)
14. \(\sim(p \lor q) \rightarrow \sim q\)
15. \((p \lor q) \rightarrow \sim r\)
16. \(\sim[(\sim p \land q) \rightarrow q]\)
17. \((\sim p \land q) \rightarrow r\)
18. \(\sim[(\sim p \land q) \rightarrow p]\)

19-23: Decide whether the given statement is true or false.

19. True or false: \((p \land q) \rightarrow (\sim p \rightarrow q)\) is a tautology. Hint: refer to the answer to #11 above.
20. True or false: \(\sim p \rightarrow q = (\sim p \land q) \rightarrow q\) Hint: refer to the answers to #11 and #16 above.
21. True or false: \((\sim p \land q) \rightarrow r\) is a tautology. Hint: refer to the answer to #17 above.
22. True or false: \((\sim p \lor q) \rightarrow \sim q\) \(\equiv[\sim(p \lor q) \rightarrow p]\) Hint: refer to the answers to #14 and #12 above.
23. True or false: \((\sim p \lor q) \rightarrow \sim q\) is a tautology. Hint: refer to the answer to #14 above.
24. Select the statement that is the **negation** of “If you are a fish, then you have cold lips.”
   A. You are a fish and you don’t have cold lips.
   B. You are a fish or you don’t have cold lips.
   C. You aren’t a fish or you have cold lips.
   D. If you aren’t a fish, then you don’t have cold lips.

25. Select the statement that is **logically equivalent** to “Class is cancelled or this is not my lucky day.”
   A. Class is cancelled and this is not my lucky day.
   B. Class is not cancelled and this is my lucky day.
   C. Class is not cancelled or this is my lucky day.
   D. If class is not cancelled then this is not my lucky day.

26. Select the statement that is **logically equivalent** to “If an offer sounds too good to be true, then I’m interested.”
   A. An offer sounds too good to be true or I’m interested.
   B. An offer doesn’t sound too good to be true, or I’m interested.
   C. An offer sounds too good to be true and I’m not interested.
   D. If I’m interested in an offer, then it sounds too good to be true.

27. Select the statement that is the **negation** of “If my computer breaks, then I won’t be able to waste so much paper.”
   A. If my computer doesn’t break then I will be able to waste so much paper.
   B. My computer breaks and I am able to waste so much paper.
   C. My computer doesn’t break or I am able to waste so much paper.
   D. If I am able to waste so much paper, then my computer didn’t break.

28. Select the statement that is **logically equivalent** to “If you want to be on my team, then you like getting bossed around.”
   A. If you don’t like getting bossed around, then you don’t want to be on my team.
   B. If you don’t want to be on my team, then you don’t like getting bossed around.
   C. If you like getting bossed around, then you want to be on my team.
   D. A, B, & C are all correct.
   E. Stop whining and get to work.

29. Select the statement that is the **negation** of “Some of us don’t have our textbooks.”
   A. None of us have our textbooks.
   B. Some of us have our textbooks.
   C. All of us have our textbooks.
   D. We have this website instead.

30. Select the statement that is **logically equivalent** to “If you have passed MAC4411, then you can’t receive credit for MGF1106.”
   A. You haven’t passed MAC4411 or you can’t receive credit for MGF1106.
   B. If you can receive credit for MGF1106, then you haven’t passed MAC4411.
   C. All of those who have passed MAC4411 are ineligible to receive credit for MGF1106.
   D. A, B and C are all correct.
31. Select the statement that is logically equivalent to “You can pick your friends or you can pick your nose.”
A. You can’t pick your friends and you can’t pick your nose.
B. You can’t pick your friends or you can’t pick your nose.
C. If you can’t pick your friends then you can pick your nose.
D. ...but you can’t pick your friend’s nose.

32. Select the statement that is logically equivalent to “If you eat that day-old burrito, you will use lots of hot sauce.”
A. If you didn’t use lots of hot sauce, then you didn’t eat that day-old burrito.
B. If you don’t eat that day-old burrito, then you won’t use lots of hot sauce.
C. If you used lots of hot sauce, then you ate that day-old burrito.
D. A, B, & C are all equivalent to the given statement.

33. Select the statement that is the negation of “All bulldogs are sweet and some poodles are mean.”
A. No bulldogs are sweet and some poodles aren’t mean.
B. No bulldogs are sweet or some poodles aren’t mean.
C. Some bulldogs aren’t sweet and no poodles are mean.
D. Some bulldogs aren’t sweet or no poodles are mean.

34. Select the statement that is the negation of “If some bees fly into your face, then all of your plans for the day are ruined.”
A. If no bees fly into your face, then all of your plans for the day are ruined.
B. If some bees fly into your face, then some of your plans for the day aren’t ruined.
C. Some bees fly into your face and some of your plans for the day aren’t ruined.
D. No bees fly into your face and none of your plans for the day are ruined.

35. Select the statement that is logically equivalent to “If all of us are OK, then all of them are losers.”
A. If all of them are losers, then all of us are OK.
B. Some of us are OK and all of them are losers.
C. If some of them aren’t losers, then some of us aren’t OK.
D. If some of us aren’t OK, then some of them aren’t losers.

36. Select the statement that is logically equivalent to “If I lock my cat in the house, then she beats up the dog.”
A. I lock my cat in the house and she doesn’t beat up the dog.
B. I don’t lock my cat in the house or she beats up the dog.
C. If I don’t lock my cat in the house, then she doesn’t beat up the dog.
D. None of these.
37. Select the statement that is the **negation** of
“If all things are considered, then I listen to public radio.”
A. If I don’t listen to public radio, then some things aren’t considered.
B. If all things are considered then I don’t listen to public radio.
C. Some things aren’t considered or I listen to public radio.
D. All things are considered and I don’t listen to public radio.

38. Select the statement that is **logically equivalent** to “We make a first down or we punt.”
A. If we don’t make a first down, then we punt.
B. We punt or we make a first down.
C. Both A & B.
D. None of these.

39. Select the statement that is the **negation** of “No campaign promises are sincere.”
A. Some campaign promises are sincere.
B. Some campaign promises are insincere.
C. All campaign promises are insincere.
D. All campaign promises are sinister.

40. Select the statement that is logically **equivalent** to "No elephants are forgetful."
A. If you aren't an elephant, then you are forgetful.
B. If you are an elephant, then you aren't forgetful.
C. If you aren't forgetful, then you are an elephant.
D. All of these.

41. Referring to #28, select the **converse** of the given statement.

42. Referring to #30, select the **contrapositive** of the given statement.

43. Referring to #37, select the **contrapositive** of the given statement.

44. Referring to #35, select the **inverse** of the given statement.

45. Select the statement that is **equivalent** to "No beggars are choosers."
A. If you aren't a beggar, then you are a chooser.
B. All beggars are choosers.
C. If one is a beggar, then one isn’t a chooser.
D. One is a beggar and one isn't a chooser.

46. Referring to #32, select the **inverse** of the given statement.
ANSWERS TO PRACTICE EXERCISES

4. Suppose p is true, q is false, s is true. Then \((\sim s \land p) \rightarrow (\sim q \rightarrow s)\) is T.
5. Suppose p is true, q is true, s is false. Then \(\sim [(s \rightarrow \sim p) \rightarrow (\sim q \rightarrow s)]\) is F.
6. Suppose p is false, q is true, r is true, s is false. Then \((\sim p \land q) \rightarrow (r \rightarrow s)\) is F.
7. Suppose p is false, q is true, s is true. Then \((\sim p \land q) \rightarrow (r \rightarrow s)\) is T.
8. Suppose p is false, q is true, r is true, s is true. Then \((p \rightarrow q) \lor (r \lor \sim s)\) is T.
9. Suppose p is false, q is true, s is false. Then \(\sim [(s \rightarrow \sim p) \lor (\sim q \rightarrow \sim s)]\) is F.
10. \((\neg p \lor \neg q) \rightarrow \neg (\neg p \lor r)\)

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>r</th>
<th>\neg p</th>
<th>\neg q</th>
<th>\neg r</th>
<th>\neg (\neg p \lor r)</th>
<th>\neg (\neg p \lor q)</th>
<th>\neg (\neg p \lor r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
</tbody>
</table>

11. \((p \land q) \rightarrow (\neg p \rightarrow q)\)

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>\neg p</th>
<th>\neg q</th>
<th>p \land q</th>
<th>\neg p \rightarrow q</th>
<th>(p \land q) \rightarrow (\neg p \rightarrow q)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
</tbody>
</table>

12. \(\neg [\neg (p \lor q) \rightarrow p]\)

| p | q | \neg p | \neg q | p \lor q | \neg p \rightarrow q | \neg [\neg (p \lor q) \rightarrow p] |
|---|---|-------|-------|---------|-------------------|----------------|----------------|
| T | T | F     | F     | F       | T                | F              |
| T | F | F     | T     | T       | T                | F              |
| F | T | T     | F     | F       | T                | F              |
| F | F | T     | T     | T       | T                | T              |

13. \((p \land q) \rightarrow (p \rightarrow q)\)

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>\neg p</th>
<th>\neg q</th>
<th>p \land q</th>
<th>p \rightarrow q</th>
<th>(p \land q) \rightarrow (p \rightarrow q)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
</tbody>
</table>
14. \((\neg p \lor q) \rightarrow \neg q\)

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>\neg p</th>
<th>\neg q</th>
<th>\neg q \lor \neg q</th>
<th>(\neg q \lor q) \rightarrow \neg q</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
</tbody>
</table>

15. \((p \lor q) \rightarrow \neg r\)

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>\neg r</th>
<th>\neg p</th>
<th>\neg q</th>
<th>(p \lor q) \rightarrow \neg r</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
</tbody>
</table>

16. \(\neg [(\neg p \land \neg q) \rightarrow q]\)

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>\neg p</th>
<th>\neg q</th>
<th>\neg p \land \neg q</th>
<th>(\neg p \land \neg q) \rightarrow q</th>
<th>\neg [(\neg p \land \neg q) \rightarrow q]</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
</tr>
</tbody>
</table>

17. \((\neg p \land \neg q) \rightarrow r\)
18. \(~[(\sim p \land q) \rightarrow p]\)

<table>
<thead>
<tr>
<th>p</th>
<th>q</th>
<th>\sim p</th>
<th>\sim q</th>
<th>\sim p \land \sim q</th>
<th>(\sim p \land \sim q) \rightarrow \sim p</th>
<th>\sim [ (\sim p \land q) \rightarrow (p) ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>T</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>F</td>
</tr>
<tr>
<td>F</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>T</td>
</tr>
<tr>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
<td>F</td>
</tr>
</tbody>
</table>

19. True
20. True
21. False
22. False
23. False

24. A  
25. D  
26. B  
27. B  
28. A  
29. C  
30. D  
31. C  
32. A  
33. D  
34. C  
35. C  
36. B  
37. D  
38. C  
39. A  
40. B  
41. C  
42. B  
43. A  
44. D  
45. C  
46. B