1 Problem 1: Trees

In this exercise, $p$ is True, $q$ is False, and $r$ is True.

1a. $(p \& q) \rightarrow q$

1d. $(p \rightarrow r) \& (p \& r)$

1f. $((p \leftrightarrow q) \leftrightarrow (r \leftrightarrow q)) \lor r$
1h. \(((r \lor q) \iff (q \iff ((q \land r) \lor p)))\) \implies \neg r
2 Problem 2: Truth tables

<table>
<thead>
<tr>
<th>a.</th>
<th>( p )</th>
<th>( q )</th>
<th>( \sim p )</th>
<th>( \sim p \lor q )</th>
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<tbody>
<tr>
<td>T</td>
<td>T</td>
<td>F</td>
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<tr>
<th>b.</th>
<th>( p )</th>
<th>( q )</th>
<th>( p \lor q )</th>
<th>( \sim (p \lor q) )</th>
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<th>c.</th>
<th>( p )</th>
<th>( q )</th>
<th>( \sim p )</th>
<th>( \sim q )</th>
<th>( \sim q \rightarrow \sim p )</th>
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3 Problem 9

9a. John gave $10 to Mary. \hspace{1cm} \text{give}(j, t, m)
9b. Mary was given $10 by John. \hspace{1cm} \text{give}(j, t, m)
9c. Toby was under the table \hspace{1cm} \text{under}(t, b)
   \( b \) is the table
9d. Clive showed Maddy the photos \hspace{1cm} \text{show}(c, m, p)
   \( p \) is the photos.
9e. China is east of Europe \hspace{1cm} \text{east-of}(c, e)
9f. Sheila is a surgeon \hspace{1cm} \text{surgeon}(s)
9g. paint(\( b, k \))
   \( k \) is the kitchen
9h. Bill was painting in the kitchen. \hspace{1cm} \text{paint}(b)
9i. Mary finally bought the painting yesterday. \hspace{1cm} \text{buy}(m, p)
   \( p \) is the painting
4 Problem 11

11a. Either Sydney or Canberra is the capital of Australia.
Either Sydney is the capital of Australia or
Canberra is the capital of Australia.
capital-of(s, a) ∨ capital-of(c, a)

11b. Alice didn’t laugh and Bill didn’t either.
∼ laugh(a) & ∼ laugh(b)

11c. Frank is not both rich and generous
∼ (rich(f) & generous(f))

11d. Gina will marry Leo or Fred
Gina will marry Leo or Gina will marry Fred

11e. Alice didn’t laugh and nor did Bill.
∼ laugh(a) & ∼ laugh(b)

11f. Skipped!

11g. Neither Bill nor Alice laughed.
∼ (laugh(b) ∨ laugh(a))

12h. Skipped!

5 Problem 15

Arguments italicized.

a. They dwelt in marble halls.
b. The theremin echose marvelously in marble halls.
c. John behaved impeccably.
d. John carelessly lost the car keys.
e. Simon carefully planned the weekend that night. The NP the weekend is
   the direct object (what’s planned), certainly an argument!
f. Simon carefully planned that night. (this sentence is is ambiguous. On
   one reading that night is the direct object, certainly an argument!)
g. The meetings lasted all day.
h. The elephants were upset and nervous all day.