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. \((r \lor q) \leftrightarrow (q \leftrightarrow ((q \& r) \lor p))) \rightarrow \sim r\)
2 Problem 2: Truth tables

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<th>p</th>
<th>q</th>
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<th>\sim p \lor q</th>
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3 Problem 9

9a. John gave $10 to Mary. give(j, t, m)
9b. Mary was given $10 by John. give(j, t, m)
9c. Toby was under the table under(t, b)
9d. Clive showed Maddy the photos show(c, p, m)
9e. Portugal is east of Europe east-of(c, e)
equally good answers
9f. Sheila is a surgeon surgeon(s)
9g. paint(b, k)
k is the kitchen
9h. Bill was painting in the kitchen. paint2(b)
9i. Mary finally bought the painting yesterday. 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.
    Alice didn’t laugh and Bill didn’t laugh either.
    ∼ laugh(a) & ∼ laugh(b)
    ∼ (laugh(a) ∨ laugh(b))
    Equivalent answers

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
    marry(g, l) ∨ marry(g, f)

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

11f. Skipped!

11g. Neither Bill nor Alice laughed.
    ∼ (laugh(b) ∨ laugh(n))
    ∼ laugh(b) & ∼ laugh(n)
    Equivalent answers

12h. Skipped!

5 Problem 15

For clarity, all arguments have been italicized, including manner, place, and
time arguments. Notice subjects and objects are always arguments.
a. They dwelt in marble halls.
b. The theremin echoes 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. 1. *Simon* carefully planned that night.
   2. *Simon* carefully planned *that night*.
      This sentence is ambiguous. On reading 2 *that night* is the direct object, certainly an argument!. Reading 2 is appropriate in a context like the following: “Simon knew his wedding night was going to be the most important night of his life. Being a methodical man, he spent two weeks doing what he always did with important events. Simon carefully planned that night.”

   g. *The meetings* lasted *all day*.
   h. *The elephants* were upset and nervous all day.