CSC 503 Homework Assignment 7

Due October 6, 2014

September 29, 2014

In the following expressions, assume that a, b, c are constant symbols, f, g, h, i, j, k are function symbols, P, Q are predicate symbols, and u, v, w, x, y, z are variable symbols.

[100 points] Give a resolution refutation of the following set of clauses. At each step, indicate the literals being resolved together and the substitutions being made. You may find it helpful to standardize variables apart in each clause and at each step.

1. $\{\neg R(x, y), S(y)\}$
2. $\{\neg R(x, y), I(x, y)\}$
3. $\{\neg S(y), \neg I(x, y), R(x, y)\}$
4. $\{\neg I(x, y), I(h(u, x), m(u, y))\}$
5. $\{\neg S(y), S(m(x, y))\}$
6. $\{R(g(x), n(g(x)))\}$
7. $\{\neg R(h(f(x), g(x)), y), R(x, y)\}$
8. $\{\neg R(a, y)\}$
9. $\{S(b)\}$
10. $\{I(b, b)\}$

Answer
Resolution

1. $\{\neg R(x_1, y_1), S(y_1)\}$
2. $\{\neg R(x_2, y_2), I(x_2, y_2)\}$
3. $\{\neg S(y_3), \neg I(x_3, y_3), R(x_3, y_3)\}$
4. $\{\neg I(x_4, y_4), I(h(u, x_4), m(u, y_4))\}$
5. $\{\neg S(y_5), S(m(x_5, y_5))\}$
6. $\{R(g(x_6), n(g(x_6)))\}$
7. $\{\neg R(h(f(x_7), g(x_7)), y_7), R(x_7, y_7)\}$
8. $\{\neg R(a, y_8)\}$
9. $\{S(b)\}$
10. $\{I(b, b)\}$
11. $\{\neg R(h(f(a), g(a)), y_7)\}$ From $8 + 7$. Substituting $\{a/x_7, y_7/y_8\}$

12. $\{\neg S(y_3), \neg I(h(f(a), g(a)), y_3)\}$ From $11 + 3$. Substituting $\{h(f(a), g(a))/x_3, y_3/y_7\}$
13. $\{\neg S(m(f(a), y_4)), \neg I(g(a), y_4)\}$ From $12 + 4$. Substituting $\{f(a)/u, g(a)/x_4, m(f(a), y_4)/y_3\}$
14. $\{\neg S(y_4), \neg I(g(a), y_4)\}$ From $13 + 5$. Substituting $\{g(a)/x_5, y_4/y_5\}$
15. $\{\neg S(y_4), \neg R(g(a), y_4)\}$ From $14 + 2$. Substituting $\{g(a)/x_2, y_4/y_2\}$
16. $\{\neg S(n(g(a)))\}$ From $15 + 6$. Substituting $\{a/x_6, n(g(a))/y_4\}$
17. $\{\neg R(x_1, n(g(a)))\}$ From $16 + 1$. Substituting $\{n(g(a))/y_1\}$
18. $\square$ From $17 + 6$. Substituting $\{a/x_6, g(a)/x_1\}$