Exercise 3: Symbolic preconditions of rules & symbolic simulation checking

1. Please compute the following preconditions.

   (a) $pre(x=y+z; , x < 2y+1 \ \&\& \ y>2)$

   (b) $pre(x = 3y; , x < y+3 \ \&\& \ y > 2)$

   (c) $pre(x = 3; , x < 2y+3 \ \&\& \ y > 5)$

2.   Please compute the following preconditions.

   (a) $pre(if \ (x <= 2z \ \&\& \ z > 8) \ x = x+1; \ else \ z = 3x; , x < y+3 \ \&\& \ y > 2)$

   (b) $pre(\ y = z+3x; \ x = x+1; \ z = 3; , x < y+3 \ \&\& \ y > 2)$
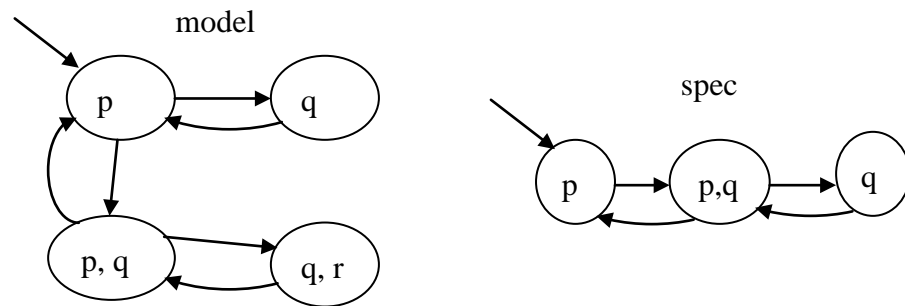
   (c) $pre(if \ (z <= x \ \&\& \ z > 8) \ x = x+1; \ else \ z = 3;$
          $y = 3*z+x;$
          $x = x+1;$
          $z = 3;,$
          $x < y+3 \ \&\& \ y > 2$
          $)$

3. Please compute the following preconditions.

   (a) $pre(while \ (x >= 2 \ \&\& \ y < 8) \ \{ \ x = x+1; \ y = y-1; \ \}, x < 5 \ \&\& \ y > 2)$

   (b) $pre(while \ (x >= y \ \&\& \ y < 8) \ y = y+2;, x > 3 \ \&\& \ y > 3)$

4. We have the following two Kripke structures.

The model uses proposition set {p,q,r} while the spec uses {p,q}.

(a) Please construct the state formulas for the two Kripke structures.

(b) Please construct the initial state formulas for the two Kripke structures.

(c) Please construct the formulas for the transition relations of the two Kripke structures.

(d) Please carry out the symbolic simulation checking algorithm for the two Kripke structures.

5. Please rewrite our symbolic simulation checking algorithm for the symbolic bisimulation checking between two Kripke structures.