```
1: if (y>0) then skip else halt;
2: x := 2y;
3: z := y;
4: if (x ≤ z) then goto 6;
5: exit;
6: error
```

Solution to exercise 10.1

(1) $init := (pc = l_1)$; $\rho_{err} := (pc = l_6)$

$\rho_1 = move(l_1, l_2) \wedge y > 0 \wedge skip(x, y, z)$

$\rho_2 = move(l_2, l_3) \wedge x' = 2y \wedge skip(y, z)$

$\rho_3 = move(l_3, l_4) \wedge z' = y \wedge skip(x, y)$

$\rho_4 = move(l_4, l_5) \wedge x > z \wedge skip(x, y, z)$

$\rho_5 = move(l_4, l_6) \wedge x \leq z \wedge skip(x, y, z)$.

$\rho_R = \rho_1 \vee \rho_2 \vee \rho_3 \vee \rho_4 \vee \rho_5$

(2) $post(init, \rho_R) = \exists pc'', x'', y'', z'' \, (pc'' = l_1 \wedge pc = l_2 \wedge y'' > 0 \wedge x = x'' \wedge y = y'' \wedge z = z'')$

$\equiv (pc = l_2 \wedge y > 0)$

$post^2(init, \rho_R) = \exists pc'', x'', y'', z'' \, (pc'' = l_2 \wedge y'' > 0 \wedge pc = l_3 \wedge x = 2y'' \wedge y = y'' \wedge z = z'')$

$\equiv (pc = l_3 \wedge x = 2y \wedge y > 0)$

$post^3(init, \rho_R) = \exists pc'', x'', y'', z'' \, (pc'' = l_3 \wedge x'' = 2y'' \wedge y'' > 0 \wedge z = z'' \wedge x = x'' \wedge y = y'')$
$pc = l_4$

$\equiv (pc = l_4 \wedge x = 2y \wedge z = y \wedge y > 0)$

$post^4(init, \rho_R) = \exists pc'', x'', y'', z'' \, (pc'' = l_4 \wedge x'' = 2y'' \wedge z'' = y'' \wedge y'' > 0 \wedge$
$[(x'' > z'' \wedge pc = l_5 \wedge x = x'' \wedge y = y'' \wedge z = z'') \vee$
$(x'' \leq z'' \wedge pc = l_6 \wedge x = x'' \wedge y = y'' \wedge z = z'')])$

$\equiv (pc = l_5 \wedge x = 2y \wedge z = y \wedge y > 0 \wedge x > z) \vee$
$(pc = l_6 \wedge x = 2y \wedge z = y \wedge y > 0 \wedge x \leq z)$

$post^5(init, \rho_R) = post^5(init, \rho_R) = post^4(init, \rho_R)$.

(3) $\rho_{reach} = (pc = l_1) \vee (pc = l_2 \wedge y > 0) \vee (pc = l_3 \wedge x = 2y \wedge y > 0) \vee (pc = l_4 \wedge x = 2y \wedge z = y \wedge y > 0) \vee$
$\vee (pc = l_5 \wedge x = 2y \wedge z = y \wedge y > 0 \wedge x > z) \vee (pc = l_6 \wedge x = 2y \wedge z = y \wedge y > 0 \wedge x \leq z)$

(4) $\rho_{reach} \wedge (pc = l_6) \equiv (pc = l_6 \wedge x = 2y \wedge z = y \wedge y > 0 \wedge x \leq z)$

unsatisfiable since if $x = 2y \wedge y > 0$ then $x > y = z$.