Decision Procedures – Homework 2

Discussed on Tuesday, 28th July, 2016.

Exercise 2.1  Proving equivalence of programs
Show that the two programs do the same, using uninterpreted functions

```
int factorial3_a (int in) {
    int i, out_a=in;
    for (i=1; i≤2; i++)
        out_a=out_a*(in-i);
    return out_a;
}
```

```
int factorial3_b (int in) {
    int out_b;
    out_b= in * (in-1) * (in-2)
    return out_b
}
```

Exercise 2.2  Ackermann’s Reduction
Apply Ackermann’s Reduction to the following term:

\[ x_1 = x_2 \land y_1 = y_2 \land F(x_1, F(x_1, G(F(x_1, y_1)))) = F(x_2, F(x_2, G(F(x_2, y_2)))) \]

Exercise 2.3  Congruence Closure
Apply the congruence closure algorithm to the following terms:

(a) \( \varphi^U_a := x_1 = x_2 \land x_2 \neq x_3 \land x_3 = x_4 \land x_4 = x_5 \land F(x_4) \neq F(x_3) \)

(b) \( \varphi^U_b := x_1 = x_2 \land x_2 = x_3 \land x_3 \neq x_4 \land F(x_1, x_2) = F(x_2, x_4) \)

(c) \( \varphi^U_c := x_1 = x_2 \land x_2 \neq x_3 \land F(x_1) = F(x_2) \land \neg(F(x_1) \neq G(x_3) \lor G(x_2) = G(x_3)) \)

(d) \( \varphi^U_d := F(F(F(x))) = x \land F(F(F(F(x)))) = x \land F(x) \neq x \)