Homework: BDDs

1. For the following functions:

$$\begin{aligned} F &= ab + c \\ G &= bc' + d \\ H &= c + d' \end{aligned}$$

   (a) Draw BDDs F, G, and H using the variable ordering

$$a < b < c < d.$$

   (b) Compute *ite*(F, G, H), and draw the corresponding BDD.

   (c) Compute *ite_constant*(F, G, H), using the algorithm presented in class. Show all steps.

25 marks

2. Let $f(x_1, x_2, x_3, x_4) = x_1{x_2}' + x_3{x_4}' + x_2x_4$, and $g(x_1, x_2, x_3) = x_1 + {x_2}'x_3$.

   (a) Draw the BDDs for f and g for the variable ordering $x_1 < x_3 < x_4 < x_2$.

   (b) Compute the BDD for $f(x_1, x_2, x_3, g(x_1, x_2, x_3))$ using the *bdd_compose* algorithm given in class.

25 marks

3. Suppose you were given a BDD for a function $f(x_1, x_2, x_3, y_1, y_2, y_3)$. How would you check if there existed functions g and h whose supports were x_1, x_2, x_3 and y_1, y_2, y_3 respectively such that

   (a) $f = g \cdot h$

(b) $f = g \oplus h$

25 marks

4. Let F be a BDD for a Boolean function $f : B^n \rightarrow B$. Suppose the cost of a minterm $(\alpha_1, \ldots, \alpha_n)$ in B^n was defined to be $\sum_{i=1}^{n} c_i \cdot \alpha_i$, where the c_i's are real-valued constants.

   Given an efficient procedure (which operates on F) for finding the cheapest minterm in the onset of f.

   20 marks