

# Logic and Computability SS21, Assignment 3

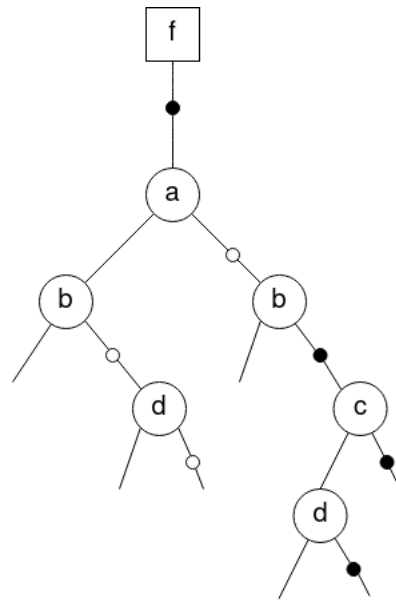
May 21, 2021

17. [1 Point]

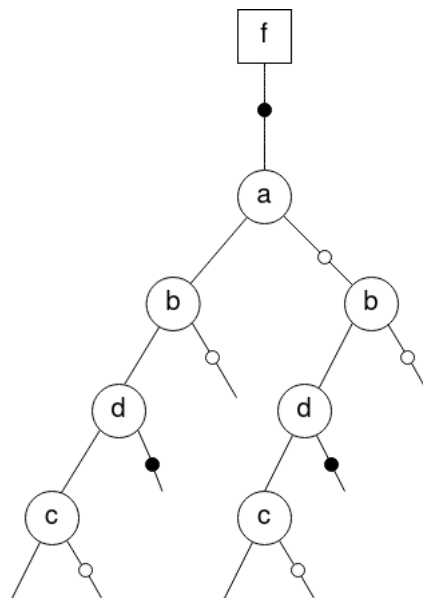
(a) Use the BDD shown in the figure on the right to check if the function it represents evaluates to *true* or *false* with the following variable assignments.

- i.  $a = \perp, b = \perp, c = \perp, d = \top$
- ii.  $a = \top, b = \perp, c = \top, d = \perp$

(b) Find a propositional formula for the function  $f$  that is represented by the BDD.



18. [1 Point] Convert the following BDD into a *reduced and ordered* BDD with variable order  $a < b < c < d$ .



19. In this task you will have to construct *reduced and ordered* BDDs. Use complemented edges and a node for  $\top$  as the only constant node. To simplify drawing, you may assume that “dangling” edges point to the constant node. Write down all cofactors and mark them in the graph that you draw.

(a) [1 Point]

$$f_1 = a \wedge (c \oplus b)$$

Use the following variable order:  $a < c < b$ .

(b) [1 Point]

$$f_2 = (a \rightarrow b) \wedge (a \oplus c)$$

Use the following variable order:  $a < b < c$ .

(c) [1 Point]

$$f_3 = (a \leftrightarrow b) \wedge (a \vee c)$$

Use the following variable order:  $b < c < a$ .

(d) [2 Points]

$$f_4 = (a \leftrightarrow c) \vee (b \wedge \neg c) \vee (d \oplus c)$$

Use the following variable order:  $a < b < c < d$ .

(e) [2 Points]

$$f_5 = c \wedge (d \leftrightarrow c) \wedge (\neg d \vee \neg a) \wedge (d \oplus (c \wedge b))$$

Use the following variable order:  $a < b < c < d$ .

(f) [1 Point]

Construct the BDD for  $f_5$  again, this time using this variable order:  $c < d < a < b$ .