

## Assignment 3

### Ex 1.

Extend typing rules for typed lambda-calculus from slides with typing rules for booleans, terms with AND, OR, and IF.

### Ex 2.

Check (step-by-step using typing rules) whether the following expressions are well-typed:

(a)  $(\lambda x:\text{Int } y:\text{Int} \rightarrow (x+5)+y) 10 (7+4)$

(b)  $(\lambda f:(\text{Int} \rightarrow \text{Int}) a:\text{Int} \rightarrow f (a+1)) 5 10$

(c)  $(\lambda x:\text{Bool} \rightarrow \text{if } x \text{ then } 5 \text{ else } 7)$

(d)  $(\lambda x:\text{Bool} \rightarrow \text{if } x \text{ then } 5 \text{ else True})$

(e)  $(\text{if True then } ((\lambda x:\text{Int } y:\text{Int} \rightarrow x+y) 10) \text{ else } (\lambda x:\text{Int} \rightarrow x+3)) 7$

(f)  $(\lambda x:\text{Bool } y:\text{Bool} \rightarrow \text{if } (x \text{ AND } y) \text{ then } 10 \text{ else } 20) \text{ True } ((\lambda x:\text{Int} \rightarrow \text{False}) 5)$