

**Dynamic Types  
Section and Practice Problems**

Week 13: Tue April 18–Fri April 21, 2023

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## 1 Dynamic types and contracts

**This material will be covered in Lecture on Tuesday April 30; we include it here so that later sections can be focused on comprehensive review.**

- (a) To make sure you understand the operational semantics of dynamic types and exceptions, show the execution of the following program under the semantics of Section 1 of the Lecture 25 notes.

```
let f = λx. 42 + x in
let g = λy. (y true) + 42 in
g f
```

- (b) Modify the program from question (a) by adding appropriate error handlers (i.e., expressions of the form `try  $e_1$  catch  $x$ .  $e_2$`  to catch the type error and return the integer 42 as the final result of the program. There are multiple places in the program where you can insert an error handler to achieve the desired result. Show three variations and their executions. (Note that the semantics for the execution of your programs is from Part 2 (Exception handling) of the Lecture 22 notes.)
- (c) Modify the program from question (a) by adding appropriate dynamic type checks to raise the error as early as possible. When does your program detect the error?
- (d) Modify the program from question (a) by adding contracts that specify the types of the input and output of  $f$  and  $g$ . Show the execution of the modified program.