Principles of Programming Languages - Homework 11

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1 Problem 1

(a)

$t_0 <: t_1$: type t_0 can be safely substituted by values of type t_1.

(i) True: Number can safely be substituted by values of Number. Follows the SubRefl rule.

(ii) False.

(iii) True: Number can safely be substituted by values of Any. Rule SubAny.

(iv) True: Var to Const is permitted by rule SubObjMut, and Number to Any by rule SubAny.

(v) False.

(vi) False.

(vii) True: since {} is a subtype of Any, and {const f: {}} is a subtype of {const f: any, var g: bool}.

(viii) False.

(ix) True.

(b)

I'm gonna assume for all of these y actually equals x. Or the variable at the top is supposed to be called y.

(i) (1): It will safely evaluate. It will produce a value. The value that fun(y).f would return would be 4. (2): TypeCall requires that the type of the argument in a call expression precisely matches the type of the function parameter that it is passed to. So it will not be well-typed with subtyping since that is not the case. The const y is missing the field g (which is a boolean).

(ii) (1) It will safely evaluate. It will produce a value. The value that fun(y).f would return would be 3. (2): TypeCall requires that the type of the argument in a call expression precisely matches the type of the function parameter that it is passed to. So it will not be well-typed with subtyping since that is not the case. The parameters are missing the field g (which is a boolean).

(iii)

(iv)