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Programming Languages and Types
Group Exercise 9

G9.1 The meaning of Type Safety

Why is progress a desirable property of a type system?
Why is preservation a desirable property of a type system?

Can an expression be type-safe and ill-typed at the same time?
Can an expression be type-unsafe and well-typed at the same time?

G9.2 Proving Type Safety

Why do we need an inversion lemma in type safety proofs?
Why do we need a canonical Forms lemma in type safety proofs?
Why do we need a substitution lemma in type safety proofs?

Why do we not need a substitution lemma in the type safety proof for the Arithmetic Expression calculus?

G9.3 Subtyping

Is subtyping a useful language feature?
What kinds of problems are particularly well-suited for using subtyping?
How would you solve these problems without subtyping, say, in Haskell?