1 Type Inference

(a) Recall the constraint-based typing judgment $\Gamma \vdash e : \tau \triangleright C$. Give inference rules for products and sums. That is, for the following expressions.

- $(e_1, e_2)$
- $\#\text{#}1\ e$
- $\#\text{#}2\ e$
- $\text{inl}_{\tau_1 + \tau_2}\ e$
- $\text{inr}_{\tau_1 + \tau_2}\ e$
- $\text{case}\ e_1\ \text{of}\ e_2\ |\ e_3$

(b) Determine a set of constraints $C$ and type $\tau$ such that

$\vdash \lambda x : A.\ \lambda y : B. \ (\#1\ y) + (x\ (\#\text{#}2\ y)) + (x\ 2) : \tau \triangleright C$

and give the derivation for it.

(c) Recall the unification algorithm from Lecture 14. What is the result of $\text{unify}(C)$ for the set of constraints $C$ from Question 1(b) above?