Q4) local X Foo in

local X in

Foo = proc {$ Y} Y=X end

X=2

end

{Foo X}

end

ST	SAS
(local.. end, ϕ)	ϕ

{local ---- end, Foo X, ϕ} | ⟨x⟩, ⟨p⟩

X → ⟨x⟩

Foo → ⟨p⟩

Foo = proc {$ Y} Y=X end, X=2 | ⟨x⟩, ⟨p⟩, ⟨y⟩

X → ⟨y⟩

Foo → ⟨p⟩

Foo X

X → ⟨x⟩

Foo → ⟨p⟩

{Foo X} | ⟨p⟩ = proc $Y Y=X end

X → ⟨x⟩

⟨y⟩ = 2

Foo → ⟨p⟩

⟨x⟩

ϕ

$\langle p \rangle = mv$

$\langle x \rangle = 2$

$\langle y \rangle = 2$

Question 5.)

Semantic Stack		SAS
local ... end , ϕ		ϕ
Record = ...	Record → ⟨r⟩	⟨r⟩
H = 1	~~Recor~~	
Y = 2	H → ⟨h⟩	⟨h⟩
T = 3	T → ⟨t⟩	⟨t⟩
case ...	X → ⟨x⟩	⟨x⟩
end	Y → ⟨y⟩	⟨y⟩

---

case ... H → ⟨h⟩ Record → ⟨r⟩

end T → ⟨t⟩

X → ⟨x⟩

Y → ⟨y⟩

⟨r⟩.feature1 = T ⟨r⟩.feature2 = H

⟨t⟩ = 3

⟨y⟩ = 2

⟨h⟩ = 1 ⟨x⟩

X = T	Record → ⟨r⟩	⟨r⟩.feature1 = T
	H → ⟨h⟩	⟨r⟩.feature2 = H
expression	T → ⟨t⟩	⟨t⟩ = 3
will evaluate	X → ⟨x⟩	⟨y⟩ = 2
to false	Y → ⟨y⟩	⟨h⟩ = 1 ⟨x⟩

<r>. feature1 = T

<r>. feature 2 = H

<t> = 3

<y> = 2

<n> = 1

<x> = 3

Q(c) $A = \lambda xyz . xz(yz)$

$B = \lambda xy . x$

$ABB =$

$$(\lambda xyz . xz(yz))(\lambda xy . x)(\lambda xy . x)$$

$$\downarrow \alpha$$

$$(\lambda xyz . xz(yz))(\lambda ab . a)(\lambda mn . m)$$

$$\downarrow \beta$$

$$\lambda z . (\lambda ab . a) z ((\lambda mn . m) z)$$

$$\downarrow \beta$$

$\underline{\underline{\lambda z . z}}$ = Identity $\underline{\underline{\text{term}}}$

~~AB BCD~~ $ASTU = SU(TU)$

$BST = S$

$ABBX =$ left associativity

$= BX(BX)$

$= \underline{\underline{X}}$

$ABBX = X \to$ identity $\underline{\underline{\text{function}}}$

Q7) Assume that $\lambda x.x$ and $\lambda y.y$ can be obtained from same term - A

Then according to the church Rosser Theorem, we can say that -

$\exists P$ such that

$$(\lambda x.x) \xrightarrow{*} P \quad \text{and} \quad (\lambda y.y) \xrightarrow{*} P$$

and there can be at most one normal form of any λ term.

But here both $\lambda x.x$ and $\lambda y.y$ are normal form of A

Therefore our assumption is wrong.

Hence contradiction

Q8) $\text{ZERO} = [\lambda x.x\,(\Lambda \neg T)\,T]$

if we give input 0 then this evaluates to true.
else it evaluates to false.

$\text{ZERO}\ 0 =$

$$(\lambda x.x\,(\Lambda \neg T)\,T)\ 0$$

$$= 0\,(\Lambda \neg T)\,T \qquad (\lambda sz.z)$$

$$= T$$

$\text{ZERO}\ 1$

$$= 1\,(\Lambda \neg T)\,T$$

$$= \Lambda \neg T\ T = \neg T \quad \text{False}$$

$$(\lambda xyz.\ \text{ZERO}(x)\ y z)$$

$\downarrow$

Required function