(a)

1. $(\lambda x.\, x\, x)(\lambda y.\, y\, x)\, z$

$= (\lambda y.\, y\, x)(\lambda y.\, y\, x).\, z$

$= (\lambda y.\, y\, x)(\lambda w.\, w\, x).\, z$

$= ((\lambda w.\, w\, x)\, x)\, z$

$= x\, x\, z$

(2) $(\lambda u\, v\, w.\, w\, v\, u)\, a\, a\, (\lambda p\, q.\, q)$

$= (w\, v.u)(\lambda p\, q.\, q)$

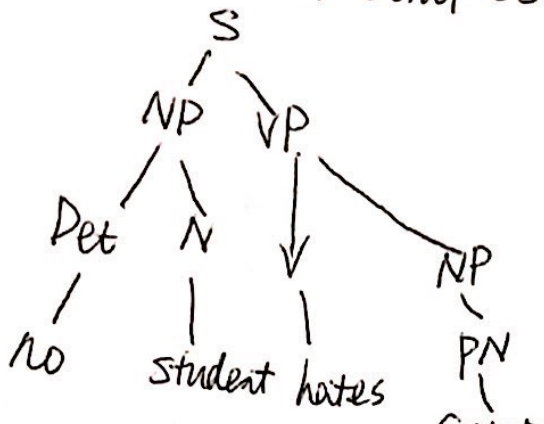
(3) $((\lambda v.\, v\, v)(\lambda u\, u))((\lambda v.\, v)(\lambda v\, w))$

$= ((\lambda u\, u)(\lambda u\, u)(\lambda v\, w)$

$= (\lambda u\, u)(\lambda v\, w)$

$= (\lambda v.\, w)$

b). No students hates COMP-550.



1. $Det.sem \equiv \lambda P \lambda Q \forall x P(x) \rightarrow \neg Q(x)$

   $N.sem \equiv \lambda x\, Student(x)$

2. $NP.sem \equiv Det.sem(N.sem)$ (subject)

   $\equiv \lambda Q \forall x(\lambda x\, Student(x))x \rightarrow \neg Q(x)$

   $\equiv \lambda Q\, \forall x\, Student(x) \rightarrow \neg Q(x)$

3. $V.sem = \lambda w \lambda z\, w(\lambda x \exists e\, Hates(e) \wedge Hater(e,z) \wedge Hatee(e,x))$

4. $PN.sem \equiv \lambda x.\, x(COMP\text{-}550)$

5. $NP.sem \equiv PN.sem = \lambda x.\, x(COMP\text{-}550)$

6. $VP.sem \equiv V.sem(NP.sem)$

7. $N.sem \equiv \lambda x\, Student(x)$

lexical rules can be got from the tree:

$S \rightarrow NP\ VP$

$NP\_Subject \rightarrow Det\ N$

$VP \rightarrow V \twoheadrightarrow NP$

$NP \rightarrow PN$

$Det \rightarrow no$

$N \rightarrow student$

$V \rightarrow hates$

$PN \rightarrow COMP\text{-}550$

$VP.sem \equiv V.sem(NP.sem)$

$= \lambda z(COMP550)(\lambda x.\, \exists e\, Hates(e) \wedge Hater(e,z) \wedge Hatee(e,x))$

$= \lambda z(\exists e\, Hates(e) \wedge Hater(e,z) \wedge Hatee(e,COMP550)) = A$

8. $S.sem = (NP.sem)(VP.sem)$

$= (\lambda Q\, \forall x\, Student(x) \rightarrow \neg Q(x))(A)$

$= \forall x\, Student(x) \rightarrow \neg(\exists e\, Hates(e) \wedge Hater(e,x) \wedge Hatee(e,COMP550))$

No student wants an exam (C)

No > an: $(\lambda Q\ \forall x\ Student(x) \rightarrow \neg Q(x), 1)$

an > No: $(\lambda Q\ \exists y\ Exam(y) \wedge Q(y), 2)$

$\exists e.\ wants(e) \wedge wanter(e, S_1) \wedge wantee(e, S_2)$

1 first:

$(\lambda Q\ \forall x\ Student(x) \rightarrow \neg Q(x))$

$(\lambda S_1\ \exists e\ wants(e) \wedge wanter(e, S_1) \wedge wantee(e, S_2))$

$= \forall x\ Student(x) \rightarrow \neg(\exists e\ wants(e) \wedge wanter(e, x) \wedge wantee(e, S_2))$

then 2:

$(\lambda Q\ \exists y\ Exam(y) \wedge Q(y))$

$(\lambda S_2.\ \forall x\ Student(x) \rightarrow \neg(\exists e\ wants(e) \wedge wanter(e, x) \wedge wantee(e, S_2))$

$= \exists y\ Exam(y) \wedge \forall x\ Student(x) \rightarrow \neg(\exists e\ wants(e) \wedge wanter(e, x) \wedge wantee(e, y))$ *

1. Interpretation: There is an exam that every student doesn't want.

2 first: an > No

$(\lambda Q\ \exists y\ Exam(y) \wedge Q(y))(\lambda S_2\ \exists e\ wants(e) \wedge wanter(e, S_1) \wedge wantee(e, S_2))$

$= \exists y\ Exam(y) \wedge \exists e\ wants(e) \wedge wanter(e, S_1) \wedge wantee(e, y)$

B

then 1:

$(\lambda Q\ \forall x\ Student(x) \rightarrow \neg Q(x))(B)$

$= \forall x\ Student(x) \rightarrow \neg \exists y\ Exam(y) \wedge \exists e\ wants(e) \wedge wanter(e, x) \wedge wantee(e, y)$ *

2. Interpretation. For every student. It doesn't exist an exam that he wants.

No > an