

1(a) LL(0)

$X \rightarrow a, X \rightarrow a_2$   
 $First_0(a, Follow(x)) \cap$   
 $First_0(a_2, Follow(x))$   
 $First_0(a_1) = \{ \epsilon \}, First_0(a_2) = \{ \epsilon \}$   
 so not LL(0) since  $\epsilon$  in both sets.

1(b) LL(1)

As in 1(a) look at  $First_1(a, Follow(x))$   
 $First_1(a, Follow(x)) =$   
 $a_1 = \{ u \}, First_1(\dots) = \{$   
 $a_2 = \{ v \}$   
 $First_1(\{ u \}) \cap First_1(\{ v \}) = \{ \}$   
 so not LL(1).

1(c) SLR(0)

SO:  $S \rightarrow T, \perp$  T - S1  
 $T \rightarrow \{ u \}$  (- S2  
 $T \rightarrow \{ u \}$  [- S3  
 $T \rightarrow \{ v \}$   
 $T \rightarrow \{ v \}$

S1:  $S \rightarrow T, \perp$   $\perp$  - S4  
 S2:  $T \rightarrow \{ u \}$  u - S5  
 $T \rightarrow \{ u \}$  v - S6  
 $u \rightarrow \{ a \}$  a - S7  
 $v \rightarrow \{ a \}$  T - S8  
 $v \rightarrow \{ T \}$  (- S9  
 $T \rightarrow \{ u \}$  [- S10  
 $T \rightarrow \{ v \}$   
 $T \rightarrow \{ v \}$   
 $T \rightarrow \{ v \}$

S7:  $u \rightarrow a, v \rightarrow a$ . Inadequate state so not SLR(0).

1(d) SLR(1)

From (c) state S7  
 $Follow(u) = \{ \perp, \}$   
 $Follow(v) = \{ \perp, \}$   
 so Follow sets do not clear up ambiguity. so not SLR(1)

1(e) LR(1)

SO:  
 $S \rightarrow T, \perp$  T - S1  
 $T \rightarrow \{ u \}, \perp$  (- S2  
 $T \rightarrow \{ u \}, \perp$  [- S3  
 $T \rightarrow \{ u \}, \perp$

S1  $S \rightarrow T, \perp$  Reduce  
 S2  $T \rightarrow \{ u \}, \perp$  u - S4  
 $T \rightarrow \{ v \}, \perp$  v - S5  
 $u \rightarrow \{ a, \}$  v - S6  
 $u \rightarrow \{ T, \}$  v - S7  
 $T \rightarrow \{ u \}, \perp$  (- S8  
 $T \rightarrow \{ u \}, \perp$  [- S9  
 $T \rightarrow \{ v \}, \perp$   
 $T \rightarrow \{ v \}, \perp$

S3  $T \rightarrow \{ u \}, \perp$  u - S10  
 $T \rightarrow \{ v \}, \perp$  v - S11  
 $u \rightarrow \{ a, \}$  v - S12  
 $u \rightarrow \{ T, \}$  v - S13  
 $T \rightarrow \{ u \}, \perp$  (- S14  
 $T \rightarrow \{ u \}, \perp$  [- S15  
 $T \rightarrow \{ v \}, \perp$   
 $T \rightarrow \{ v \}, \perp$

S4  $T \rightarrow \{ u \}, \perp$  [- S16  
 S5  $T \rightarrow \{ v \}, \perp$  ) - S17

S6  $u \rightarrow a, \}$  ) - Reduce u -> a  
 $v \rightarrow a, \}$  ) - Reduce v -> a

S7  $u \rightarrow T, \}$  ) - Reduce u -> T  
 $v \rightarrow T, \}$  ) - Reduce v -> T

S8  $T \rightarrow \{ u \}, \perp$  u - S4  
 $T \rightarrow \{ v \}, \perp$  v - S5  
 $u \rightarrow \{ a, \}$  v - S6  
 $u \rightarrow \{ T, \}$  v - S7  
 $T \rightarrow \{ u \}, \perp$  (- S8  
 $T \rightarrow \{ u \}, \perp$  [- S9  
 $T \rightarrow \{ v \}, \perp$   
 $T \rightarrow \{ v \}, \perp$

S9  $T \rightarrow \{ u \}, \perp$  u - S10  
 $T \rightarrow \{ v \}, \perp$  v - S11  
 $u \rightarrow \{ a, \}$  v - S12  
 $u \rightarrow \{ T, \}$  v - S13  
 $T \rightarrow \{ u \}, \perp$  (- S14  
 $T \rightarrow \{ u \}, \perp$  [- S15  
 $T \rightarrow \{ v \}, \perp$   
 $T \rightarrow \{ v \}, \perp$

S10  $T \rightarrow \{ u \}, \perp$  ) - S16

S11  $T \rightarrow \{ u \}, \perp$  [- S17  
 S12  $u \rightarrow a, \}$  ) - Reduce u -> a  
 $v \rightarrow a, \}$  ) - Reduce v -> a

S13  $T \rightarrow \{ u \}, \perp$  Reduce

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