QUIZ 2

Date: 13th February 2003 Max. Marks 35

1. Calculate the $FIRST$ and $FOLLOW$ sets for the grammar shown below and then construct the LL(1) parsing table

   $S \rightarrow u\ B\ D\ z$
   $B \rightarrow B\ v \mid w$
   $D \rightarrow E\ F$
   $E \rightarrow y \mid \epsilon$
   $F \rightarrow x \mid \epsilon$ (5 Marks)

   Ans:

   $FIRST(S) = \{u\}$ $FOLLOW(S) = \{\$\}$
   $FIRST(B) = \{w\}$ $FOLLOW(B) = \{v, x, y, z\}$
   $FIRST(D) = \{y, x, \epsilon\}$ $FOLLOW(D) = \{z\}$
   $FIRST(E) = \{y, \epsilon\}$ $FOLLOW(E) = \{x, z\}$
   $FIRST(F) = \{x, \epsilon\}$ $FOLLOW(F) = \{z\}$

	u	z	v	w	y	x	$\$$
S	$S \rightarrow u\ B\ D\ z$						
B				$B \rightarrow B\ v \mid w$			
D		$D \rightarrow E\ F$			$D \rightarrow E\ F$	$D \rightarrow E\ F$	
E		$E \rightarrow \epsilon$			$E \rightarrow y$	$E \rightarrow \epsilon$	
F		$F \rightarrow \epsilon$				$F \rightarrow x$	

2. Please answer all parts of this question *without explicitly drawing the parsing table anywhere.*

   A *no* answer to a question - *Is this grammar LR(1)?*, for example, has to be justified by writing the parsing table entry with a conflict. A *yes* answer requires no explanation. However there is a catch – an incorrect *yes* answer will attract negative marks. You may, of course, choose not to answer the question.

   (a) Is the following grammar (a) LL(1)? (b) SLR(1)? (c) LR(1)?
   $S \rightarrow AaAb \mid BbBa$
   $A \rightarrow \epsilon$
   $B \rightarrow \epsilon$

Ans: (a) The grammar is LL(1). A string starting with a a is expanded using the first production for S, and one starting with a b is expanded using the second.

(b) The grammar is not SLR(1). For the viable prefix ϵ and the input symbol a or b, the entries are reduce using $A \rightarrow \epsilon$ and $B \rightarrow \epsilon$.

(c) Yes this grammar is LR(1). The lookaheads aid in deciding which of the two productions is to be used. For the viable prefix ϵ, the set of items contains $A \to \epsilon\circ, a$ and $B \to \epsilon\circ, b$.

(b) Is the following grammar (a) LL(1)? (b) SLR(1)? (c) LALR(1)?

$S \to Aa \mid bAc \mid dc \mid bda$
$A \to d$

Ans: (a) The grammar is not LL(1). *parsing-table[S,d]* would contain $S \to Aa$ and $S \to dc$.

(b) The grammar is not SLR. For the viable prefix bd and the inout symbol a the entries would be *shift to state representing viable prefix bda* and *reduce using production* $A \to d$.

(c) The grammar is LALR(1). For the viable prefix bd, the set of items contain $A \to d, c$. This will prevent a reduce on a.

(c) Is the following grammar (a) SLR(1)? (b) LALR(1)? (c) LR(1)?

$S \to Aa \mid bAc \mid Bc \mid bBa$
$A \to d$
$B \to d$

Ans: (a) The grammar is not SLR(1). For the viable prefix d and input symbol a or c, the action table will contain two entries, reduce using $A \to d$ and $B \to d$.

(b) The grammar is not LALR(1). For the state corresponding to the combined viable prefixes d and bd, the action table will contain two entries, reduce using $A \to d$ and $B \to d$.

(c) The grammar is LR(1). For the viable prefix d, the items are $A \to d, a$ and $B \to d, c$. Similarly, for the viable prefix bd, the items are $A \to d, c$ and $B \to d, a$. Thus there are no clashes.

(d) Is the following grammar (a) LALR(1)? (b) LR(1)? (c) LL(1)?

$S \to (\ X \mid E\ ] \mid F\ )$
$X \to E\ ) \mid F\ ]$
$E \to A$
$F \to A$
$A \to \epsilon$

Ans: (a) The grammar is not LALR(1). The items for the viable prefix ϵ are $E \to A.,]$ and $F \to A.,)$. Similarly, the items for the viable prefix (are $E \to A.,)$ and $F \to A.,]$. Merging the two items, we get $E \to A.,]\ )$ and $F \to A.,]\ )$. This gives rise to a reduce reduce conflict.

(b) The grammar is LR(1). See above for an explanation.

(c) The grammar is LL(1). The first symbols of the right hand sides of the production for S are all different. Similarly for X.

3. Show a grammar which is LL(2) but not LR(1). You might help correction by giving a brief and clear explanation of your answer. (6 Marks)

Ans: $S \to Mab \mid Nac$
$M \to \epsilon$
$N \to \epsilon$