Assignment(Module-3,4,5)

[submission deadline 25th March 2025]

CSE304: Compiler Construction

Q.1 Check whether the following grammar is LL(1), LR(0), SLR(1), CLR(1) and LALR(1) or not? If grammar is CLR(1) or LALR(1), then construct a Parsing table for that parser.

$a)\ S \rightarrow (L)/a$ $L \rightarrow L,S/S$	$b)\ S \rightarrow L = R$ $S \rightarrow R$ $L \rightarrow * R$ $L \rightarrow id$ $R \rightarrow L$	$c)\ S \rightarrow AaAb/BbBa$ $A \rightarrow \in$ $B \rightarrow \in$	$d)\ S \rightarrow Aa/bAc/Bc/bBa$ $A \rightarrow d$ $B \rightarrow d$

Q.2: (i) Construct a CLR(1) Parsing table for the grammar given in part c) and parse the string **ab**

(ii) Construct a LALR(1) Parsing table for the grammar given in part d) and parse the string **bda**

Q.3: Consider the following grammar

$\boldsymbol{S \rightarrow Aa|bAc|dc|bda}$

$\boldsymbol{A \rightarrow d}$

(a) Check whether the given grammar is SLR(1) or not?

(b) Construct a LALR(1) parsing table (using LR(1) items DFA).

(c) Parse the string $\boldsymbol{bdc}$

Q.4 What is symbol table? Discuss any method to implement a symbol table.

Q.5 Translate the following expression into quadruples, triples and indirect triples.
- (a*b) + (b+c) – (a+b+c+d)

Q.6 Differentiate between synthesized attributes and Inherited attributes in SDT.

Q.7 Construct a syntax-directed translation (SDT) scheme for desktop calculator for the input string 3*5+4. Draw the annotated parse tree also?

Q.8 Let the attribute **val** gives the value of octal number generated by S in the following grammar:

$S \rightarrow L.L/L$

$L \rightarrow LO/O$

$O \rightarrow 0/1/2/3/4/5/6/7$

For example an input $(15.25)_8 = (13.3230)_{10}$, that is, $\boldsymbol{s.val = 13.3230}$ for the input value 15.25.

Construct a SDT scheme using only synthesized attributes to determine **s.val**

Q.9 Consider the following code

$\boldsymbol{Sum = 0;}$
$\boldsymbol{For(i = 1;\ i \leq 20; i++)}$
$\boldsymbol{\ \ Sum = sum + a[i] + b[i];}$

(a) Generate three address code
(b) Create basic blocks and control flow graph.
(c) Construct a DAG representation of 3 address code generated in part(a)

Q.10 Write a 3-address code for the following program fragment, where a and b are arrays of size 20*20 and there are 8 bytes per word (that is W=4):

$sum = 0;$
$i = 1;$
$j = 1;$
do
$\{$
$sum = sum + a[i, j] * b[j, i];$
$i = i + 1;$
$j = j + 1;$
$\}$
$while(i \leq 10\ \&\&\ j \leq 10);$

Q.11 Explain the following with an example:

(a) Code Optimization Phase
(b) Peephole optimization
(c) Reduction in strength
(d) Induction variable elimination

Q.12

Consider the following code which computes the inner product of 2 vectors:

```
Prod  := 0;
I   := 0;
Repeat  {
        Prod  :=  prod + a[i]  *  b[i]
        I = I + 1;
Until
I > 20;
}
```

Below is possible IR for this program:

```
1)  Prod  := 0
2)  I  : =1
3)  T1  := 4 * i
4)  T2  := a [T1]
5)  T3  := 4 * i
6)  T4  := b [T3]
7)  T5  :=  T2 * T4
8)  T6  := prod + T5
9)  Prod  :=  T6
10) T7  :=  I + 1
11) I = T7
12) If  I < 20  goto (3)
13) ……
```

Create basic blocks and the control flow graph and also show any optimizations. If you find.

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