ANNA UNIVERSITY
BE - CSE V SEM

CS6109 – Compiler Design
Mid Semester Exam

DATE: 15-11-2021 TIME: 1:30 hr **MAX MARKS: 25**

Answer any 5

1. Create SLR Parse Table for the following grammar and mention whether they belong to LR(0).

$S \rightarrow L . L \mid L$
$L \rightarrow L B \mid B$
$B \rightarrow 0 \mid 1$

OR

2. Create SLR Parse Table for the following grammar and mention whether they belong to LR(0).

$A \rightarrow AB$
$A \rightarrow \varepsilon$
$B \rightarrow aB$
$B \rightarrow b$

********* Q1 or Q2 ***********

3. Provide a suitable string of size 7 as input to any of the SLR table created in **Q1 or Q2** and Parse them. (i) Accept string (ii) Error String

4. Find is the following grammar is LL(0) or LR(0)? Parse and verify with the input string W = **aca$**

$S \rightarrow XSa \mid Yc$
$A \rightarrow aY \mid YY$
$B \rightarrow bSa \mid cX \mid \varepsilon$

5. Compute FIRST and FOLLOW for the grammar after Left Recursion Elimination

$S \rightarrow aAF$
$A \rightarrow F \mid B \mid C$
$B \rightarrow D+$
$C \rightarrow E*$
$D \rightarrow x \mid y \mid z \mid \varepsilon$
$E \rightarrow a \mid b \mid c$
$F \rightarrow A \mid \varepsilon$

6. Show that the following grammar is LR(0) or LALR(1) or CLR(1). Show how it does not belong to the other varieties.

```
S -> AS | b
A -> SA | a
```

7. Construct nondeterministic finite automata NFA and then DFA for the following regular expressions using the algorithm discussed in class. Show the sequence of moves made by each in processing the input string **ababbab**.

Regular Expression: **(a|b)*abb(a|b)***

********ALL THE BEST**********

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CS6109 – Compiler Design P Batch

13.12.2021 Time: 60 mins Max Marks: 20

Answer the following for 20 marks

1. Show that the following grammar is LR(1) but not LALR(1). (8 marks)
   S → Aa | bAc | Bc | bBa
   A → d
   B → d

OR

2. Is the following grammar LL(1) or SLR(1)? (8 marks)
   S → SA | A
   A → d

3. Use the array addressing translation to convert the f0ollowing assignment to ICG form:
   X = a[i][j] + b [c [k]] + d
   i) Draw the annotated parse tree (4 marks)
   ii) Write 3 address code statement (4 marks)
   iii) What is the address location for a[4][5], b[4] and c[5] if their base addresses are 1000, 2000 and 3000 respectively and max size of these arrays are declared are integer with a[10][10], b[15] and c[20] and c[5] = 9 as well. (4 marks)

OR

4. Convert the Boolean expression to 3 address code and place in a triple
   If(((a>100 && (!b))&& c>200)|| (((c<a) && b>35) || d < 100)) x=0;
   i) Draw the annotated parse tree (4 marks)
   ii) Write 3 address code statement (4 marks)
   iii) Apply backpatching to the conversion (4 marks)

All The Best!!!

[(a>100 && !b) && c<200] || [(c<a && b>35) || d<100]

Roll No. | | | | | | | | | | |

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VI Semester
CS6109 - Compiler Design

Tutorial - II

Date: 20.12.2021
Time: 1 hr 15 mins **Answer ALL Questions** **Max. Marks: 30**

PART – A (5 x 2 = 10 Marks)

1. Construct the DAG for the basic Llock and perform the code improving transformation on the code represented by the block.

```
d = b * c
e = a + b
b = b * c
a = e – d
```

2. Write short notes on Peephole optimization with an example.
3. Write short notes on code generation issues.
4. Draw the DAG representation of three address statement and identify the killed node in it.

```
b = 12 +1
x = b[i]
b[j] = y
```

5. Generate code for the three address statement sequence assuming 'a' and 'b' are arrays whose elements are 4 – byte values.

```
x = a[i]
y = b[x]
a[i] = y
```

PART B (20 Marks)

6. a) Write short notes on code generation algorithm and explain the function getReg. Translate the basic block consisting of the three address statements into machine instructions using register and address descriptors. (5)

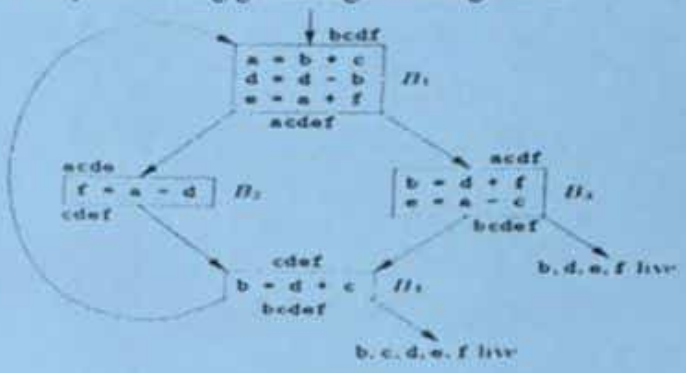
```
t = a – b
u = a – c
v = t + u
a = d
d = v + u
```

(or)

b) Optimize the code by eliminating common sub expression, performing reduction in strength on induction variable and eliminating all the induction variables. (5)

```
      dp =0;
      i =0;
L :   t1 = i * 8;
      t2 = A[t1];
      t3 = i * 8;
      t4 = B[t3];
      t5 = t2 * t4;
      dp = dp + t5;
      i = i+ 1;
      if i < n goto L;
```

7. a) Explain in details about register allocation and assignment. Calculate the usage count and identify the code sequence using global register assignment. (7)



(or)

b) Discuss the optimal code generation algorithm using dynamic programming technique. Explain the generation of optimal code using dynamic programming technique for the statement (s + t) * (c - d) / f * (a - b). Assume that the machine having two registers and compute the cost vector to find minimum cost of the following instructions. (7)

LD Ri, Mj
op Ri, Ri, Rj
op Ri, Ri,Mj
LD Ri, Rj
ST Mi, Rj

8. What is a basic block and flow graph. Write the algorithm for partitioning three address code into basic blocks. Translate the following program into three address statements. Assume the matrix entries are numbers that require 16 bytes and that matrices are stored in row major order. Construct the flow graph for your code and identify the loops in your flow graph. (8)

```
for (i = 0; i < n; i++)
        for (j = 0; j < n; j++)
                if ( j % 2 = = 0 )
                    c[i][j] = c[i][j] + 1;
                else
                    c[i][j] = c[i][j] - 1;
```

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CS6109 – Compiler Design

V Semester

Assignment - I

13	Construct LL(1) parsing table after pre-processing the given grammar E-> E+T/T, T->T*F/F, F->(E) / id. Validate id+id*id and id ++id
14	Construct SLR parsing table the given grammar E-> E+T/T, T->T*F/F, F->(E) / id. Validate id+id*id and id ++id
15	Construct CLR parsing table for S -> L=R, S -> R, L -> *R, L -> id, R -> L and validate id=*id and id**id
16	Construct LALR parsing table for S -> L=R, S -> R, L -> *R, L -> id, R -> L and validate id=*id and id**id
17	a) Write down the required syntax directed translation schemes for the following code segment and construct the annotate parse tree along with generation of the corresponding three address code. a[i][j][k] = c*a[i][j][j]

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CS6109 – Compiler Design

V Semester

Assignment - II

1.

Construct the parsing table for LALR grammar and verify the given string ((↑ , a) , a) is accepted or not.

S → a | ↑ | (T)
T → T , S | S

2.

Construct the SLR Parser table for the given grammar.

S → a | ↑ | (T)
T → T , S | S

3.

(i) Construct LALR Parsing Table for the following grammar

S → Aa | bAc | Bc | bBa
A →d
B →d

(ii) Construct Predictive Parsing Table for the following Grammar:

S -> (L)|a , L->L,S|S