Code No: V3223 **R07** **Set No: 1**

III B.Tech. II Semester Supplementary Examinations, December - 2012

COMPILER DESIGN

(Computer Science and Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Describe the language denoted by regular expression 0*10*10*10*
   b) Explain the need for dividing the compilation process into various phases and explain its functions. [8+8]

2. a) Find the predictive parser for the following grammar and parse the sentence (a+b)*c
   E→ E+T|T
   T→ T*F|F
   F→ (E)| id
   b) Find the SLR table for the following grammar
   E→ E+E
   E→E*E
   E→(E)
   E→ id
   Parse the sentence a+b*c [8+8]

3. a) Consider the grammar
   S→CC
   C→ cC|d
   Construct LR(1) items
   b) Construct the LALR parsing table for the following grammar
   S→ B
   B→ begin DA end
   D→ Dd|E
   A→ A|E
   E→ B|S
   List all the computed information that is required. [8+8]

4. a) Explain in detail about bottom up evaluation of s-attributed definitions
   b) Which of the following recursive type expressions are equivalent? Justify your answer?
   e1 = integer→ e1 e2 = integer→ (integer→ e2) e3 = integer→ (integer→ e1) [8+8]

5. a) Describe in detail about heap storage allocation.
   b) Explain in detail about the organization for block structured languages. [8+8]

6. a) What is a flow graph? How to construct a DAG? Discuss the steps for DAG construction?
   b) Give a detailed account on loop optimization techniques. [8+8]

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7. a) What is flow-graph. Explain how given program can be converted into flow-graph?
   b) Describe in detail about global optimization. [8+8]

8. a) Describe how addressing modes can be used for reducing the memory access time.
   b) Explain the simple Strategy to generate assembly code from Quadruples. [8+8]

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Code No: V3223 **R07** **Set No: 2**

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COMPILER DESIGN

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Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

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*****

1. a) Explain with one example how LEX program will perform the lexical analysis for the following patterns in C: identifiers, comments, numerical constants and arithmetic operators.
   b) Give the minimized DFA for the following expression (a|b)* abb [8+8]

2. a) Construct recursive descent parser for the following grammar of regular expressions
   E→ E+T|T
   T→TF|F
   F→ F*|a|b
   b) Given the following grammar
   S→ AS|b
   A→ SA|a
   Construct a SLR parsing table for the string baab [8+8]

3. a) Explain the procedure of filling the entries in the SLR table.
   b) Consider the following augmented grammar
   $S \rightarrow E_1$
   $E_1 \rightarrow T_3E_1|T_1$
   $E_2 \rightarrow T_3E_2|T_2$
   $T_1 \rightarrow a\$|(E_2\$$
   $T_2 \rightarrow a)|(E_2)$
   $T_3 \rightarrow a+|(E_2+$
   Find the canonical sets of items. [8+8]

4. a) Explain in detail how an L-attributed grammar can be converted into a translator scheme.
   b) For the input expression (4*7+1)*2 construct an annotated parse tree according to syntax directed definition of desk calculator. [8+8]

5. a) Describe about storage allocation for arrays in detail.
   b) Write and explain about Runtime storage administration? [8+8]

6. a)Construct the DAG for the statement: Z=X-Y+X+(Y/U)-V*W+X+V and find the register requirement for its evaluation. Assume that all variables are of fixed type and all operations require a single register. If only two registers are available, find the code generated for this statement.
   b) What are loop invariant components? Explain how they affect the efficiency of a program. [8+8]

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7. a) In the source code
   X= a*a + 2*a*b + b*b;
   Y=a*a-2*a*b + b*b;
   contains how many number of common sub expressions. Explain in detail where they are located.
   b) Describe in detail about peephole optimization .Discuss about the characteristics of peephole optimization. [8+8]

8. a) What is machine dependent code optimization? On what factors it depends? Describe any two machine independent code optimization techniques
   b) Consider the following code sequence.
      i) MOV B, R0
         ADD C, R0
         MOV R0, A
      ii) MOV B,A
         ADD C, A
   Calculate the cost of the above instructions in terms of access time and memory usage. [8+8]

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Code No: V3223 **R07** **Set No: 3**

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COMPILER DESIGN

(Computer Science and Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

All Questions carry equal marks

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1. a) Define lexeme, token and pattern. Identify the lexemes that make up the tokens in the following program segment. Indicate corresponding token and pattern.

```
void swap (int i, int j)
        {
        int t;
        t=i;
        i=j;
        j=t;
          }
```

b) Construct minimum state DFAs for the following regular expressions.

(i) (a+b)* a (a+b)

(ii) (a+b)* a (a+b) (a+b)

(iii) (a/b)* a (a/b)(a/b)(a/b) [8+8]

2. a) Consider the following grammar

E→ TE'

E'→ +TE'| ε

T→ FT'

T'→*FT'| ε

F→(E)|id

Consider the predictive parsing table and show the stack implementation for the input string id+id * id

b) Construct LL(1) parse table for the following grammar

S→ Aa|bAc|Bc|bCa

A→ d

B→d [8+8]

3. a) What is ambiguous grammar. Draw an ambiguous parse tree for the following PASCAL statement

```
if  a>b
then
if a=b then a:= c+d
else  b:=c-d;
```

b) What is Shift-Reduce and Reduce-Reduce conflict? How these can be resolved? With examples explain in which condition S-R and R-R conflict can occur in SLR, canonical LR and LALR parsers. [8+8]

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4. a) Give a syntax directed definition to differentiate expression formed by applying the arithmetic operators + and * to the variable x and constants eg: x* (3*x +x*x) .
   b) Generate intermediate code generation for the following code along with the required translation scheme

```
int a,b;
float c;
a=10;
switch(a)
        { case 10:c=1;
      case 20:c=2;
        }
```

[8+8]

5. a) Discuss about the stack allocation strategy of runtime environment with an example?
   b) An array A is declared in FORTRAN as : Dimension A(8,10) . The implementation uses a column –major strategy and the array begins at byte 100. If each element of A occupies 4 bytes, at what byte does element A(4,7) ? [8+8]

6. a) Explain in detail about frequency reduction and constant folding with examples.
   b) Construct the DAG for an expression:
   a:=b*-c+b*-c [8+8]

7. a) Explain in detail about Reducible Flow Graphs.
   b) What is induction variable? Explain induction variable elements with an example. [8+8]

8. a)Discuss in detail about the issues in the design of code generator.
   b) Explain in detail about object code forms and give examples. [8+8]

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Code No: V3223 **R07** **Set No: 4**

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COMPILER DESIGN

(Computer Science and Engineering)

Time: 3 Hours **Max Marks: 80**

Answer any FIVE Questions

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1. a) Write a LEX specification to read a C program and calculate the number of new line characters, tabs and white spaces in the program.
   b) What are various phases of compiler .Explain each phase in detail. Write down the output of each phase for expression a:= b*c +50.0 [8+8]

2. a) Construct the predictive parser for the following grammar
   S->a|1^|(T)
   T->T,S|S
   Write down the necessary algorithms and define FIRST and FOLLOW. Show the behavior of the parser in the sentences:
   (i)(a,(a,a))
   (ii)(((a,a),1^,(a),a).
   b) Consider the following grammar
   E →T + E|T
   T → V-T|V
   V → id

   Write down the procedures for the non-terminals of the grammar to make a recursive descent parser. [8+8]

3. a) Construct the LALR parsing table for the following grammar
   S'→ S
   S→CC
   C→cC|d
   b) What are the rules for "Closure operation" in SLR parsing? Explain the rules for GOTO operation in LR parsing. [8+8]

Code No: V3223 **R07** **Set No: 4**

4. a) Translate executable sentences of the following C program.

```
main()
{
inti=1;int a[10];
while (i <= 10)
{
a[i] = 0;
i = i + 1;
}
}
```

into
i) Syntax tree
ii) Postfix notation
iii) Three-address code.
b) Give a syntax directed definition to translate infix expression into infix expression without redundant parentheses for e.g. since + and * associate to the left
((a*(b+c))*(d)) can be rewritten as a* (b+c) *d [8+8]

5. a) Explain about block structured and non block structured allocation in detail.
b) What is a symbol table? Explain the need for symbol table organization and data structures used for implementing a symbol table. [8+8]

6. a)Construct DAG for the following Basic block:

```
d:=b*c
e:=a+b
b:=b*c
a:=e-d
```

b) Explain about considerations for optimization and discuss about scope of optimization in detail. [8+8]

7. a) Determine the pre-dominant block of block B2 in the program flow graph from the following code

```
…../* Block B0*/
20 go to 200 /* Block B1*/
200 go to 20 /* Block B2*/
```

b) “Copy propagation Leads to dead code” - Justify the statement. [8+8]

8. a) Discuss in detail about machine dependent code optimization.
b) Explain in detail about register allocation and assignment generic code generation algorithms. [8+8]

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