Ex/IT/T/315/2017(S)

B. INFO. TECH 3RD YEAR 1ST SEMESTER SUPPLEMENTARY EXAMINATION, 2017

(1st Semester)

PRINCIPLES OF COMPILER DESIGN

Time: Three hours

Full Marks : 100

*Answer Question No. 1 and Attempt any **THREE** questions from the rest*

1. Answer the following questions.

(a) Construct a Control Flow Graph. Identify the scopes of optimization in this control flow graph.

(1) i = 1
(2) j = 1
(3) t1 = 5 * i
(4) t2 = t1+ j
(5) t3 = 4 * t2
(6) t4 = t3
(7) a[t4] = – 1
(8) j = j + 1
(9) if j < = 5 goto (3)
(10) i = i + 1
(11) if i < 5 goto (2)

Construct a Control Flow Graph. Identify the scopes of optimization in this control flow graph.

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(b) Consider the following code segment.

for index = 50 *to* 30 *step* – 5
begin
var1 = var1*2;
if (index == 30) *and* (var1 > 403) *then*
break;
end

(i) Write the 3-address code of the given code snippet.
(ii) Write appropriate grammars to generate such given code.
(iii) Draw a parse tree.
(iv) Attach semantic actions to the grammar for the *for* loop. Assume that that body of the for loop is obtained from *S*.

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(c) Consider the following grammar

Σ = {a, [,], ","}
E → [L] | a
L → ET
T → , L | $\in$

Construct the First and Follow Sets and then construct the Predictive Parsing Table for the above grammar.

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2. Answer the following questions.

   i) A lexical analyzer may be built using a Deterministic Finite State Automata. How does a lexical analyzer may be built using a Deterministic Finite State Automata?

   ii) Consider the grammar

   $S \rightarrow AS \mid \epsilon$
   $A \rightarrow A1 \mid 0A1 \mid 01$

   Show that the grammar is ambiguous. Use the string 00111.
   Construct an equivalent unambiguous grammar.

   iii) Consider the following grammar with $\Sigma = \{num, +\}$

   $S \rightarrow E{+}S \mid E$
   $E \rightarrow num$

   Construct the LR(0) sets of items.

3+(2+5)+10

3 Answer the following questions.

a) Generate Three address code for the following C like Code

   (i) A[3][2] = 6. Assume that A is defined as *int A[10][10];*
   (ii) if a < 4 or b > 2 and c== 1 then x = 1 else x = a+b+c+4
   (iii) sum (a, b, c)
   (iv) aRecord.aField = 2. Assume that *aRecord* is a *struct* type variable. The *struct* has a component called *aField.*
   (v)

```
switch (a+b+c) {
    case 1:
    x = 1
    break;
    case 2:
    x = 2;
    break;
}
```

b) Write the grammar for generating a switch-case statement. You can assume standard grammars to generate expressions, number literals and statements.

c) When do we say that there is a shift-reduce conflict in a LR(0) parsing table? How is it handled in SLR parsing technique?

(2+4+2+2+4)+2+(2+2)

4 Consider the following questions.

a) What is an LR(0) item? Write the algorithm of a LR(0) parser given an input string and the LR(0) parsing table.

b) Define any simple grammar for conditional statements and write the semantic actions for each production rule of your grammar. Assume that the grammar for conditions is given along with the translation of the standard non terminals

(2+8)+(4+6)

5 Answer the following questions.

c) Write the algorithm to remove left recursion from a context free grammar.
d) What is an LR(1) item? Define the *Closure* and *Goto* functions for LR(0) items.
e) Name 4 global code optimization techniques. Explain two of them.
f) What is an activation record? What are the contents of an activation record?

4+(2+3+3)+(2+4+2)