Code No: V3147

R07

Set No: 1

III B.Tech. I Semester Supplementary Examinations, November/December - 2012
AUTOMATA AND COMPILER DESIGN
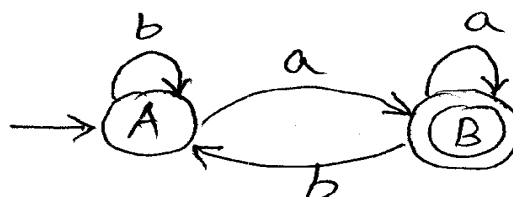(Information Technology)

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

Answer any FIVE Questions
All Questions carry equal marks
*****

1. (a) Show that the simplified regular expression recognized by the following DFA is the set of all strings of *a*'s and *b*'s that end with letter *a*.

   (b) Show that the following regular expression identities are equivalent:
      (i) $r^+ = r^* r^+$ (ii) $(r + s)^* = (r + s^*)^*$ [8+8]

2. (a) Construct a context free grammar for generating the balanced parentheses, like ( ),
   [ ], [( ) ( )], ([ ]), etc. and find the moves of the grammar to derive the string: ([( )] ( ))
   (b) Find the entries: M[S, i] and M[R, \$] of the predictive parse table, M of the following
   grammar: [8+8]

   $$S \to FR$$
   $$R \to *S \mid \in$$
   $$F \to i$$

3. Consider the grammar: $S \to (S) \mid a$
   (a) Construct the DFA for SLR(1), CLR(1), and LALR(1) parsers
   (b) Find the number of states in each of the parser.   [8+8]

4. (a) Compare inherited attributes and synthesized attributes with an example.
   (b) Construct quadruples, triples, and indirect triples of the following expression by
   assuming the usual rules of precedence for the operators:
   $(a + b) > (c + d)$ OR $a > c$ AND $b < d$ [8+8]

5. (a) What is type checking? How does it work? Compare static and dynamic type checking
   techniques with suitable examples.
   (b) What is a polymorphic function? Give an example.
   (c) Compare context sensitive and context free languages with suitable examples. [8+4+4]

6. (a) Explain, in detail, the storage allocation for strings, arrays and records.
   (b) Consider the array declaration in 'c': float a[100][100]; Assume that the main memory
   in byte addressable and that the array is stored starting from the memory address 100. What
   is the address of a[40][50]?
   (c) What is a display? Describe its need with an example.   [8+4+4]

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7. (a) What is a code optimization? Explain a machine dependent and machine independent code optimization with suitable examples.
   (b) Explain data flow analysis of structured programs with suitable examples.   [8+8]

8. (a) How registers are allocated and assigned in order to generate good code? Explain with an example.
   (b) What is a basic block? Construct a DAG for the following basic block:
   t1 = t2 * t3;   t2 = t6 + t4;   t3 = t4 - e;   t4 = t5 * t8;   t5 = t6 - c;   t6 = a + b;   t8 = d + e;
   [8+8]

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AUTOMATA AND COMPILER DESIGN
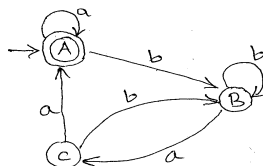(Information Technology)

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

Answer any FIVE Questions
All Questions carry equal marks
*****

1. (a) Find the regular expression for the following finite automaton:

(b) Design a DFA that accepts the language over the alphabet, $\Sigma = \{0, 1, 2\}$ where the decimal equivalent of the language is *not* divisible by 3.   [8+8]

2. (a) Give the context free grammar that generates the set $\{0^n 1^n \mid n \geq 1\}$
   (b) Build an LL(1) parse table for the following production grammar: [8+8]

   Program $\rightarrow$ begin d semi X end
   X $\rightarrow$ d semi X $|$ s Y
   Y $\rightarrow$ semi s Y $|$ $\in$

3. Consider the following augmented grammar:

   S $\rightarrow$ A
   A $\rightarrow$ BA $|$ $\in$
   B $\rightarrow$ aB $|$ b

   (a) Construct the LR(1) parser.
   (b) Find the moves made by the LR(1) parser on the input string: a a b b   [8+8]

4. Consider the following:

   E $\rightarrow$ E$_1$ # T {E.val := E$_1$.val * T.val}
   E $\rightarrow$ T {E.val := T.val}
   T $\rightarrow$ T$_1$ & F {T.val := T$_1$.val * F.val}
   T $\rightarrow$ F {T.val := F.val}
   F $\rightarrow$ num {F.val := num.Lexval}

   (a) Draw an annotated parse tree for an expression: a # b & c # d & e
   (b) Compute the 'E.val' for root of an annotated parse tree of the following expression:
   2 # 3 & 5 # 6 & 4   [8+8]

5. (a) What is a type expression? Explain the equivalence of type expressions with an example.
   (b) Explain the chomsky's hierarchical theorem.
   (c) Compare polymorphic and overloading of functions with an example.   [8+4+4]

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6. (a) What is an activation record? Explain its components with an example.
   (b) What is a dangling reference problem in storage allocation? Write the 'C' functions which likely to cause dangling reference problem.   [8+8]

7. (a) What is dataflow analysis? Explain about various dataflow analyzers.
   (b) Explain, in detail, about peephole optimization with suitable examples.   [8+8]

8. (a) What are various object code forms? Explain.
   (b) What is a register allocation and assignment? Give an example.
   (c) Write the code generation algorithm. Test the algorithm for the following expression:
        W = (A - B) * (A - C - B) + (A – B - C)   [5+5+6]
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Set No: 3

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**AUTOMATA AND COMPILER DESIGN**
(Information Technology)

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

Answer any FIVE Questions
All Questions carry equal marks
*****

1. (a) Design a DFA that accepts the language over $\Sigma = \{0, 1\}$ of all strings that contain neither the sub-string 00 nor the sub-string 11.
   (b) When are two regular expressions said to be equivalent? Find the regular expression for the following finite automaton: [8+8]
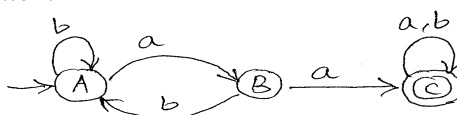
2. (a) Construct a context free grammar for possible sequences of **if** - **else** in 'C' and find the moves of the grammar to derive the if - else sequence of the string: i i e i e
   (b) Find the entries: M[S, i] and M[R, \$] of the predictive parse table, M of the following grammar: [8+8]

   $S \rightarrow FR$
   $R \rightarrow *S \mid \in$
   $F \rightarrow i$

3. (a) What is meant by a parser generator? How are ambiguities resolved in YACC? Explain.
   (b) Consider the following augmented grammar:

   $A' \rightarrow A$
   $A \rightarrow (A) \mid a$

   Construct the LR(0) parser and find the moves made by the LR(0) parser on the input string:
   $((a))$ [8+8]

4. (a) Design an abstract syntax tree for the expression: a = (a[i+1] = 2) + a[j]
   (b) Let synthesized attribute, Val give the value of the binary number generated by **S** in the following grammar. For example, on input 101.101, S.Val = 5.625.

   $S \rightarrow L \bullet L \mid L$
   $L \rightarrow LB \mid B$
   $B \rightarrow 0 \mid 1$

   Write synthesized attribute values corresponding to each of the productions to determine the S.Val [8+8]

5. (a) What is type checking? How does it work? Compare static and dynamic type checking techniques with suitable examples.
   (b) What is a Polymorphic function? Give an example.
   (c) Compare context sensitive and context free languages with suitable examples. [8+4+4]

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6. (a) What is a display? Describe its need with an example.
   (b) Consider the following **"C"** declaration:

   ```
   struct
   {
           short s1[5];  long l;  union { short s2;    float y;    long z; }u;
   }t;
   ```

   Assume that the objects of the type short, float, and long occupy 2 bytes, 4 bytes, and 8 bytes,   respectively. Find the storage requirement for variable 't', ignoring alignment considerations.
   (c) An array A is declared in FORTRAN as: DIMENSION(8, 10). The implementation uses column-major strategy and the array begins at 100. If each element of A occupies 4 bytes, at what byte does element A(4, 7)?   [6+5+5]

7. (a) Explain data flow analysis of structured programs with suitable examples.
   (b) What is a code optimization? Explain, in detail, about local optimization, loop optimization and peephole optimization with suitable examples.   [8+8]

8. (a) Describe, in detail, about the issues in the design of code generator.
   (b) Write the code generation algorithm. Test the algorithm for the following expression:
   W = (A - B) + (A - C) + (A - C) + (A - C)   [8+8]

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Set No: 4

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AUTOMATA AND COMPILER DESIGN
(Information Technology)

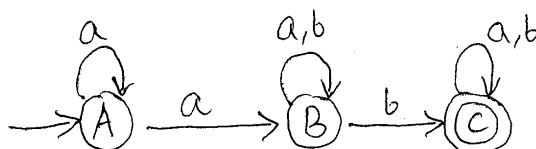**Time: 3 Hours**   **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
*****

1. (a) Construct a DFA equivalent to the following NFA diagram:

   (b)Prove the following regular expression identities:
   $\in + 1^* (011)^* (1^* (011)^*)^* = (1 + 011)^*$
   $1 + (\in + 0)(\in + 0)^* 1 = 0^* 1$ [8+8]

2. (a) Write a context free grammar for the **while** statement in 'C' language.
   (b) Build an LL(1) parse table for the following production grammar: [8+8]

   Program $\rightarrow$ begin d semi X end
   X $\rightarrow$ d semi X $|$ s Y
   Y $\rightarrow$ semi s Y $| \in$

3. (a) What are Kernel and Non-kernel items? Obtain the Kernel items of the LR(0) parser for
   the grammar:

   A $\rightarrow$ A'
   A' $\rightarrow$ a A' $|$ b

   (b) Explain how to parse an ambiguous grammar. How are ambiguities resolved in YACC?
                                                                                          [8+8]

4. (a) What is an attribute grammar? Give an example.
   (b) Translate the executable statements of the following 'C' program into a three-address
   code by   assuming each element of an array **'a'** takes 4 bytes.   [6+10]
   void main()
   {
           int i = 1, a[10];
           while(i++ <= 10)a[i] = 0;
   }

5. (a) What is LBA? What is PDA? Explain, in detail, with suitable diagrams and examples.
   (b) Explain the chomsky's hierarchical theorem.
   (c) Compare polymorphic and overloading of functions with an example.   [8+4+4]

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6. (a) Explain, in detail, the storage allocation for strings, arrays and records.
(b) What is a dangling reference problem in storage allocation? Write the 'C' functions which likely to cause dangling reference problem. [8+8]

7. (a) What is dataflow analysis? Explain, in detail, global data flow analysis.
(b) Write and explain live variable analysis algorithm with an example. [8+8]

8. (a) What is the role of code generator? What is the purpose of next use information in code generation? Give an example.
(b) Write the code generation algorithm. Test the algorithm for the following expression:
W = (A - B) * (A - C - B) + (A – B - C) [8+8]
*****