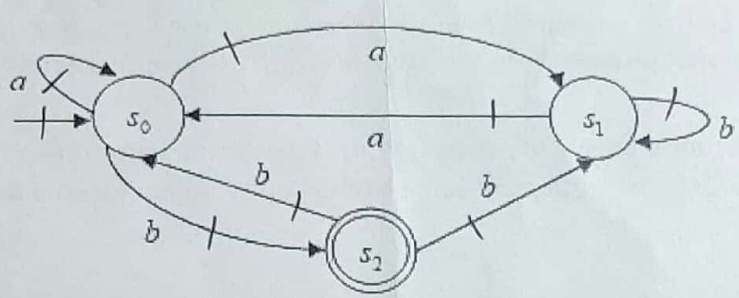
Final Assessment Test – November 2018

VIT
Vellore Institute of Technology

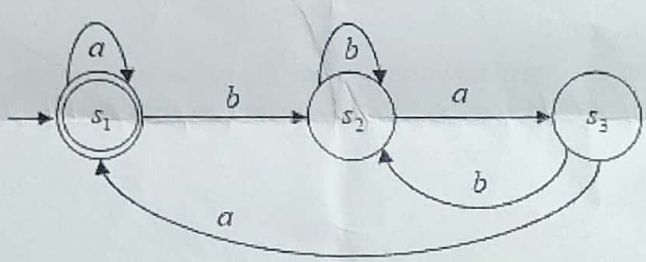
Course: CSE2002 - Theory of Computation and Compiler Design
Class NBR(s):5380 / 5381 / 5408 / 5409 / 5410 / 5413 / 5414 / 5427 / 6855 / 6960
Slot: A1+TA1+TAA1
Time: Three Hours
Max. Marks: 100

Answer any TEN Questions
(10 X 10 = 100 Marks)

1. a) Construct a state diagram of the deterministic finite automata equivalent to the following non-deterministic finite automata. [4]



b) Construct a regular expression for the following state diagram using Arden's theorem or state contraction method. [6]



2. a) Construct a context free grammar G generating the language $(L_1 \cup L_2)$, where $L_1 = \{a^n b^m a^m b^n \mid m, n \geq 1\}$ and $L_2 = \{bba^n \mid n \geq 0\}$. [4]

b) Construct a pushdown automaton to accept the language L, where $L = \{a^m b^{2m} \mid m \geq 1\} \cup \{a^n b^n \mid n \geq 1\}$. [Hint. Non-deterministic PDA]. [6]

3. a) Show that the context free grammar $G = (\{Q_0, A, B\}, \{a, b\}, P, Q_0)$, where P is the set of productions $Q_0 \rightarrow Aa \mid bB \mid \lambda$, $A \rightarrow bQ_0 \mid \lambda$ and $B \rightarrow aA$ is ambiguous. [5]

b) Show that the context free grammar G having productions $Q_0 \rightarrow AB$, $A \rightarrow DD \mid DA$, $B \rightarrow CC \mid CB$, $C \rightarrow 0$ and $D \rightarrow 1$ produces at least one word. [5]

4. a) Write in brief about the different phases of a compiler. [4]

b) Construct the LL parsing table for the grammar G having productions E → AA, A → aA, and A → b where E is the start variable, A is the non – terminal and a,b are terminals. [6]

5. a) Prove that $L = \{0^m 1^n \mid \text{G.C.D}(m, n) = 1\}$ is not regular. [5]

b) Construct a dfa for the regular expression (a/b)* aab using direct method. [5]

6. a) Transform the following grammar into equivalent Chomsky Normal Form. [5]

S → abAB
A → bAB | λ
B → BAa | A | λ

b) Determine whether the string $z = 1101$ is in the language generated by the context free grammar $Q_0 \to AB|0$, $A \to BBB|1$ and $B \to AB|BA|0$. Use membership algorithm to support your answer. [5]

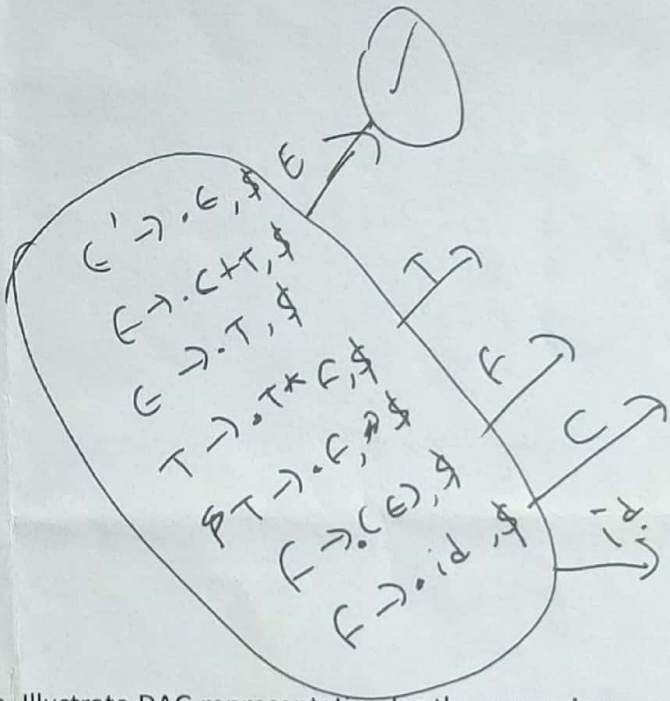
7. Construct a CLR parser for the grammar *G* having productions $E \to E + T \mid T$; $T \to T * F \mid F$; and $F \to (E) \mid id$, where *E* is the start variable. Parse the string $id + (id * id)$ with your construction. [10]

8. Construct a Turing machine for proper subtraction $(m \div n)$. Proper subtraction $(m - n)$ is defined to be $(m - n)$ for $m \geq n$, and zero (0) for $m < n$. Support your construction by taking at least one example of each case. [10]

9. What do you mean by three address code? Write various instruction forms in perception with three address code. Write three address code for the expression $x = -(a+b)*(c+d)+(a+b+c)$ and represent thro' quadraples and Triples. [10]

10. Why code optimization is necessary in compiler design. For the following code segment, obtain the basic blocks and draw a control flow graph. [10]

```
w = 0;
x = x + y;
y = 0;
if (x > z)
  {
    y = x;
    x++;
  }
else
  {
    y = z;
    z++;
  }
w = x + z;
```



11. Discuss the various issues in the code generation design. Illustrate DAG representation for the expression $t = (a+b)*(a+b+c)$ [10]

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read → write, move