

INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Date 21.09.2005 FN / AN Time: 2 Hrs.

Full Marks 30 No. of Students: 58

Autumn Semester:, 2005

Department: Computer Science and Engineering

Sub. No: CS 43001

3rd and 4th Yr. B. Tech.(Hons.)

Sub. Name: Compiler Construction

Instructions : Answer **all** the questions.

1. (a) Write context free grammar to detect strings over the alphabet set {a,b}, having equal number of a's and b's.
(b) Write down the regular expressions to check correct syntax for the E-mail address.
(c) What does the regular expression $a(ab)^*a$ mean.
(d) What is `yylval` in Lex.
(e) What is panic mode error recovery strategy.
(f) Explain Left-factoring.
(g) What is LL(k) parsing.
(h) State one difference between macro and inline function.
(i) Write down the regular expression for any decimal number that is multiple of 5.
(j) What is ϵ closure of a set s in NFA.
(k) Write context free grammar to detect occurrence of balanced parenthesis.
(l) What is handle in a bottom-up parser. [$\frac{1}{2} \times 12$]
2. (a) Construct the NFA for the expression $a(a|b)^*ab$ by using Thompson's Construction methodology.
(b) Derive the DFA from the corresponding NFA. [3 \times 2]
3. (a) Eliminate left recursion (both immediate and general) from the following grammar
 $S \rightarrow Aa \mid b$
 $A \rightarrow Ac \mid Sd \mid \epsilon$
(b) Given the grammar
 $S \rightarrow iEtSS' \mid a$
 $S' \rightarrow eS \mid \epsilon$
 $E \rightarrow b$
produce its first and follow list.
(c) Given the grammar
 $exp \rightarrow exp + exp$
 $exp \rightarrow exp * exp$
 $exp \rightarrow (exp)$
 $exp \rightarrow id,$
test, using a shift reduce parser, whether the input string $id1 + id2 * id3$ conforms to the grammar. Show all the steps executed in the *stack-input string* format to ultimately accept the string. There can be two different ways to parse the string. Illustrate both the ways.

(d) Give an example of each shift-reduce and reduce-reduce conflict. [2 + 2 + 3 + 1]

4. (a) Define operator grammar.

(b) Given the grammar

$\text{exp} \rightarrow \text{exp} + \text{exp}$

$\text{exp} \rightarrow \text{exp} * \text{exp}$

$\text{exp} \rightarrow \mathbf{id}$,

build up the operator precedence table and parse the input string $\mathbf{id1} + \mathbf{id2} * \mathbf{id3}$ using the operator precedence table. Show all the steps clearly. [1 + 4]

5. Given the grammar

$S \rightarrow aABe$

$A \rightarrow Abc$

$A \rightarrow b$

$B \rightarrow d$,

form its SLR parsing table.

[5]