

*This question paper contains 4 printed pages.*

**6134**

*Your Roll No. . . . .*

**MCA / IV Sem.**

**J**

**MCA 401 - COMPILER DESIGN**  
(Admissions of 2007 and onwards)

*Time 3 hours*

*Maximum Marks 60*

*(Write your Roll No on the top immediately  
on receipt of this question paper)*

***Attempt all questions.***

***Parts of a question must be answered together.***

1. a) Write a regular expression that generates the same language as the following grammar  
$$A \rightarrow aA \mid B \mid \epsilon$$
$$B \rightarrow bB \mid A$$
 02
  
  - b) Write a context free grammar that generates the same language as the following regular expression  
 $(a \mid c \mid ba \mid bc)^* b$  02
  
  - c) What is meant by peehole optimization? 02
- 2 Consider the grammar
- $$\text{lexp-seq} \rightarrow \text{lexp-seq lexp} \mid \text{lexp}$$
- $$\text{lexp} \rightarrow \mathbf{atom} \mid \text{list}$$
- $$\mathbf{atom} \rightarrow \mathbf{number} \mid \text{identifier}$$
- $$\text{list} \rightarrow (\text{lex-seq})$$
- a) Remove left recursion

PT.O

- b) Construct FIRST and FOLLOW sets for the non-terminals of the resulting grammar.
- c) Construct the LL(1) parsing table for the resulting grammar
- d) Show the actions of the corresponding LL(1) parser, given the input string  
(b (2) ) 12

3 Consider the grammar

$$S' \rightarrow S$$

$$S \rightarrow (S) S/E$$

- a) Construct the DFA to be used in SLR parsing
- b) What are the valid states for the viable prefix '( ( ' ? Justify.
- c) Construct the initial state for the LR (1) parsing.
- d) Determine the valid states for the viable prefix '(( ( ' 12

4 a) Consider the attribute grammar

Grammar Rule	Semantic Rule
$decl \rightarrow type \text{ var-list}$	$var-list \text{ dtype} = type.dtype$
$type \rightarrow int$	$type.dtype = integer$
$type \rightarrow float$	$type \text{ dtype} = real$
$varlist_1 \rightarrow id, var-list_2$	$id.dtype = var-list_1 \text{ dtype}$ $var-list_2 \text{ dtype} = var-list_1 \text{ dtype}$
$var-list \rightarrow id$	$id \text{ dtype} = var-list.dtype$

Show that if the attribute type dtype is kept on the value stack during an LR parser, than this value cannot be found at a fixed position in the stack when reductions by the rule  $var-list \rightarrow id$  occur 04

b) Show that the grammar given below is not LR(1) Can it be LR(K) for some suitable k. Justify.

$B \rightarrow ABb / a$

$A \rightarrow \epsilon$

04

5 Consider the following grammar for type expression

$\text{var-decls} \rightarrow \text{var-decls}; \text{vardecl} / \text{var-decl}$

$\text{var-decls} \rightarrow \text{id}, \text{type-exp}$

$\text{type-exp} \rightarrow \text{simple-type} / \text{structured - type}$

$\text{simple-type} \rightarrow \text{int} / \text{bool} / \text{real} / \text{char} / \text{void}$

$\text{structured - type} \rightarrow \text{array} [ \text{num} ] \text{ of type - exp} /$

$\text{record var - decls end} /$

$\text{union var - decls end}$

Write pseudocode for checking type equivalence. 06

6 Write pseudocode for code generation for control statements described by the grammar :

$\text{stmt} \rightarrow \text{if - stmt} / \text{while - stmt} / \text{break} / \text{other}$

$\text{if - stmt} \rightarrow \text{if - ( exp ) stmt} / \text{if ( exp ) stmt else stmt}$

$\text{while - stmt} \rightarrow \text{while ( exp ) stmt}$

$\text{exp} \rightarrow \text{true} \setminus \text{false}$  06

7 a) Consider the following grammar rule

$S \rightarrow \text{while} ( C ) S_1$

Outline the implementation of synthesized attributes as well as inherited attributes for the above grammar in LR parsing. You may make necessary modification to grammar without changing the language. 04

b) How does yacc resolve reduce / reduce and shift / reduce conflicts. 02

P.T.O.

c) Consider the following grammar along with semantic rules :

<b>Production</b>	<b>Semantic Rule</b>
$D \rightarrow TL$	$L.int = T.type$
$T \rightarrow int$	$T.type = integer$
$T \rightarrow float$	$T.type = float$
$L \rightarrow L_1, id$	$L_1.int = L.int$ $addtype(id.entry, L.int)$
$L \rightarrow id$	$addtype(id.entry, L.int)$

Give a annotated parse tree for the following expression  
int a, b,c. 04

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