



**MAULANA ABUL KALAM AZAD UNIVERSITY OF  
TECHNOLOGY, WEST BENGAL**

Paper Code : CS-702

**COMPILER DESIGN**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

**GROUP - A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for the following :  $10 \times 1 = 10$

i) Which of the following is an example of bottom up parsing ?

- a) LL parsing
- b) Predictive parsing
- ☒ c) Recursive descent parsing
- ☒ d) Shift-reduce parsing.

ii) The output of the parser is

- a) tokens
- b) syntax tree
- c) parse tree
- d) non-terminals.

iii) If  $x$  is a terminal, then  $\text{FIRST}(x)$  is

- a)  $\epsilon$
- ☒ b)  $\{x\}$
- c)  $x^*$
- d) none of these.

iv) YACC builds up

- a) SLR parsing table
- ☒ b) LALR parsing table
- c) canonical LR parsing table
- d) none of these.

v) Which one of the following is a top-down parser ?

- ☒ a) Recursive descent parser
- b) Operator precedence parser
- c) An LR(k) parser
- d) An LALR(k) parser.

- vi) Cross-compiler is a compiler
- a) which is written in a language that is different from the source language
  - b) that generates object code for host machine
  - c) which is written in a language that is same as the source language
  - d) that runs on one machine but produces object code for another machine.
- vii) An ideal compiler should
- a) be smaller in size
  - b) take less time for compilation
  - c) be written in a high level language
  - d) produce object code that is smaller in size and executes faster.
- viii) Synthesized attribute can easily be simulated by an
- a) LL grammar
  - b) LR grammar
  - c) ambiguous grammar
  - d) none of these.

- ix) Type checking is normally done during
- a) lexical analysis
  - b) syntax analysis
  - c) syntax directed translation
  - d) code generation.
- x) The method which merges the bodies of two loops is
- a) loop rolling
  - b) loop jamming
  - c) constant folding
  - d) none of these.

### GROUP - B

#### ( Short Answer Type Questions )

Answer any *three* of the following.  $3 \times 5 = 15$

2. Consider the context-free grammar :

$$S \rightarrow SS + \mid SS * \mid \epsilon$$

- a) How the string  $aa + a*$  can be generated by this grammar ?
- b) Construct a parse tree for this string.

3 + 2

3. What is handle ? Consider the grammar  
 $E \rightarrow E + E \mid E * E \mid id$

Find the handles of the right sentential forms of the reduction for the string  $id + id * id$  2 + 3

4. Eliminate the left-recursion for the following grammar :

$$S \rightarrow ( L ) \mid a$$

$$L \rightarrow LS \mid S$$

5. Construct the DAG for the following basic block :

$$d = b * c$$

$$e = a + b$$

$$b = b * c$$

$$a = e - d$$

6. What is recursive descent parsing ? Describe the drawbacks of recursive descent parsing for generating the string 'abc' from the grammar :

$$S \rightarrow aBc$$

$$B \rightarrow bc \mid b$$
 2 + 3

### GROUP - C

#### ( Long Answer Type Questions )

Answer any three of the following.  $3 \times 15 = 45$

7. a) Construct NFA from the regular expression using Thompson's method  $L = aa ( a \mid b )^* ab$ .  
 b) Write regular definition for the following language :  
 All strings of letter that contain the five vowels in order.  
 c) Construct the predictive parsing table for the following grammars :

$$S \rightarrow AaAb \mid BbBa$$

$$A \rightarrow \epsilon$$

$$B \rightarrow \epsilon$$
 5 + 4 + 6

8. Construct the LR(0) set of items and the SLR parsing table for the following grammar :

$$E \rightarrow E + \underline{T} \mid \underline{T}$$

$$T \rightarrow \underline{T} * \underline{F} \mid \underline{F}$$

$$F \rightarrow (\underline{E}) \mid \underline{id}$$
 5 + 10

9. a) Translate the following expression :  
 $m = m + n * -p + n * -p$  into  
 (i) Quadruples, (ii) Triples, (iii) Indirect triples.  
 b) What are the differences among Quadruples, Triples and Indirect triples ?  
 c) Design a direct acyclic graph for the string :  
 $a + a * ( b - c ) + ( b - c ) * d$  ( 3 + 3 + 3 ) + 3 + 3

10. a) Consider the following grammar :

$$S \rightarrow CC$$

$$C \rightarrow cC \mid d$$

Find the LR(1) set of items.

- b) Describe about the operator precedence parser.
- c) What are the two types of attributes that are associated with a grammar symbol ?       $8 + 5 + 2$

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