



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

CS-702

COMPILER DESIGN

Time Allotted: 3 Hours

Full Marks: 70

*The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.*

**GROUP A
(Multiple Choice Type Questions)**

1. Answer *all* questions. 10×1 = 10
- (i) Role of preprocessor is to
- | | |
|--------------------------------|---------------------------------|
| (A) produce output data | (B) produce output to compilers |
| (C) produce input to compilers | (D) none of these |
- (ii) A Top-Down Parser generates
- | | |
|---------------------------|--------------------------------------|
| (A) left most derivation | (B) right most derivation in reverse |
| (C) right most derivation | (D) none of these |
- (iii) Type checking is done normally during
- | | |
|---------------------------------|---------------------|
| (A) lexical analysis | (B) syntax analysis |
| (C) syntax directed translation | (D) code generation |

- (iv) The language produced by the regular grammar $S \rightarrow aS|bS|a|b$ is
- (A) a^*b^* (B) aa^*bb^*
(C) $(a+b)^*$ (D) $(a+b)(a+b)^*$
- (v) The grammar $S \rightarrow S\alpha_1|S\alpha_2|\beta_1|\beta_2$
- (A) is left recursive
(B) has common left factor
(C) is left recursive and also has common left factor
(D) is a CFG
- (vi) A basic block can be analyzed by a
- (A) DAG (B) Flow graph
(C) Graph with cycles (D) None of these
- (vii) Which of the following is not an intermediate code form?
- (A) Quadruples (B) Triples
(C) Abstract syntax tree (D) Indirect triples
- (viii) An inherited attribute is one whose initial value at a parse tree node is defined in terms of
- (A) attribute values of its children only
(B) attribute values of itself and its children
(C) attribute values of its parents and/or its siblings
(D) none of these
- (ix) Consider the program statement $b = 2$ where b is a boolean variable. Which stage of compilation can detect this error?
- (A) Lexical analysis (B) Syntax analysis
(C) Semantic analysis (D) Code generation
- (x) Given the grammar $S \rightarrow ABc$, $A \rightarrow a|\epsilon$, $B \rightarrow b|\epsilon$ FOLLOW(A) is the set
- (A) $\{\$ \}$ (B) $\{b\}$
(C) $\{b, c\}$ (D) $\{a, b, c\}$

GROUP B
(Short Answer Type Questions)

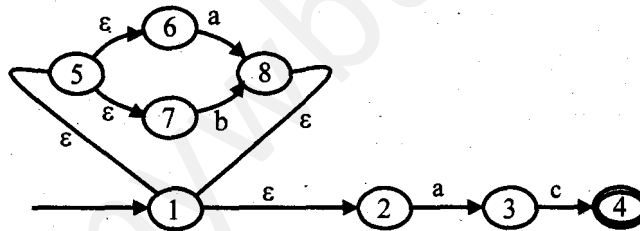
Answer any *three* questions. 3×5 = 15

2. Explain inherited attribute and synthesized attribute for syntax directed translation with suitable example. 5
3. What is activation record? Explain clearly the components of activation record. 1+4
4. Generate an annotated parse tree for the string "3 + 2 - 4" using the grammar 5

$$E \rightarrow E + T \mid E - T \mid T \quad T \rightarrow 0 \mid 1 \mid 2 \mid \dots \mid 9$$
5. Describe the algorithm for eliminating left recursion from a CFG. Eliminate left recursion from the following grammar. 2+3

$$S \rightarrow A a \mid b$$

$$A \rightarrow A c \mid S d \mid \epsilon$$
6. Convert the following NFA to an equivalent DFA 5



GROUP C
(Long Answer Type Questions)

Answer any *three* questions. 3×15 = 45

7. (a) How the following statement is translated via the different phases of compilation? Explain. 5

$$\text{MOTION} = \text{DISTANCE} + \text{RATE} * \text{DISPLACEMENT} + 70.$$
- (b) What is an operator precedence parser? List the advantages and disadvantages of operator precedence parsing. 2+3

- (c) What do you mean by Thomson Construction? Explain with an example. 5
8. Consider the following grammar: 10+5
 $E \rightarrow E + T/T$
 $T \rightarrow T * F/F$
 $F \rightarrow (E)/id$
 (i) Obtain the FIRST and FOLLOW sets for the above grammar.
 (ii) Construct the predictive parsing table for the above grammar.
9. Consider the grammar $G = \{V, T, S, P\}$; where $V = \{S, A\}$, $T = \{a, b\}$, S is the start variable and $P = \{S \rightarrow AS|b, A \rightarrow SA|a\}$. 6+6+3
 (i) Compute the collection of sets of LR(0) item sets for the grammar.
 (ii) Construct the SLR parsing table using the SLR algorithm.
 (iii) Show all moves allowed by the table from (ii) on the input *abab*.
- 10.(a) Generate three-address code for the code fragment 6

$$\begin{array}{l} \text{while } (i < 10) \\ \{ \quad x = 0; \\ \quad y = x + 2; \\ \quad i = i + 1; \\ \} \end{array}$$
 and implement it in quadruples, triples and indirect triples.
- (b) Translate the arithmetic expression $a * -\left(b + \frac{c}{d}\right)$ into syntax tree and postfix notation. 4
- (c) Assuming 3 registers available generate machine code for the instruction 5

$$X = \frac{a}{-(b * c)} - d.$$
11. Write short notes on any *three* of the following: 3×5
 (a) Dependency Graph
 (b) L-attribute definition
 (c) Peephole optimization
 (d) Left factoring
 (e) Symbol table