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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: V - THEORY EXAMINATION (2024- 2025)

Subject: Compiler Design

Time: 3 Hours

Max. Marks: 100

General Instructions:*IMP: Verify that you have received the question paper with the correct course, code, branch etc.**1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.**2. Maximum marks for each question are indicated on right -hand side of each question.**3. Illustrate your answers with neat sketches wherever necessary.**4. Assume suitable data if necessary.**5. Preferably, write the answers in sequential order.**6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.***SECTION-A**

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1. Attempt all parts:-

- 1-a. The phase of Compiler Design is / are (CO1, K1) 1
- (a) Lexical analysis.
- (b) Syntax analysis.
- (c) Semantic analysis.
- (d) All the mention
- 1-b. A compiler is known as _____ for a high-level language that runs on one machine and produces code for a different machine. (CO1, K1) 1
- (a) Cross compiler
- (b) Multipass compiler
- (c) Optimizing compiler
- (d) One pass compiler
- 1-c. Syntax Analysis is the _____ phase of compiler. (CO2, K1) 1
- (a) Second
- (b) Third
- (c) First
- (d) none of above
- 1-d. The default Lookahead of Augmented production rule is _____. (CO2, K1) 1
- (a) id

- (b) *
- (c) \$
- (d) none of above
- 1-e. Type checking is normally done during _____. (CO3, K1) 1
- (a) Code optimization
- (b) Syntax directed translation
- (c) Lexical analysis
- (d) Syntax analysis
- 1-f. Symbol table can be used for _____. (CO3, K1) 1
- (a) Finding name's scope
- (b) Type checking
- (c) Keeping all of the names of all entities in one place
- (d) All of the mentioned
- 1-g. The optimization which avoids test at every iteration is called _____. (CO4, K1) 1
- (a) Loop unrolling
- (b) Loop jamming
- (c) Constant folding
- (d) None of above
- 1-h. Loop optimization technique is / are _____. (CO4, K1) 1
- (a) Invariant code
- (b) Induction analysis
- (c) Strength reduction
- (d) All of the above.
- 1-i. Optimization can be categorized broadly into ____ types. (CO5, K1) 1
- (a) 2
- (b) 3
- (c) 4
- (d) 5
- 1-j. DAG is an abbreviation of _____. (CO5, K1) 1
- (a) Detecting Acyclic Graph
- (b) Data Acyclic Graph
- (c) Dynamic Acyclic Graph
- (d) Directed Acyclic Graph

2. Attempt all parts:-

- 2.a. Describe the interactions between the lexical analyzer and the parser. (CO1, K1) 2
- 2.b. Write algorithm for FIRST function. (CO2, K1) 2

- | | | | |
|------|---|-----------|---|
| 2.c. | Explain L-attributed syntax directed translation. | (CO3, K1) | 2 |
| 2.d. | Describe the advantage of quadruple over triples. | (CO4, K1) | 2 |
| 2.e. | Define the term "Reduction in strength". | (CO5, K1) | 2 |

SECTION-B

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3. Answer any five of the following:-

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|------|---|-----------|---|
| 3-a. | Explain the concept of Finite automata and Regular Expression. Write the Steps for converting the regular expression to Finite Automata. | (CO1, K2) | 6 |
| 3-b. | Classify the Concepts of Compiler and Interpreter. | (CO1, K2) | 6 |
| 3-c. | Explain the algorithm for constructing CLR parsing table. Construct the CLR parsing table for following grammar: | (CO2, K3) | 6 |
| | S → AA
A → aA / b | | |
| 3-d. | Explain the following term in short notes: | (CO2, K2) | 6 |
| | (i) Ambiguity (with example),
(ii) Recursive Descent Parser
(iii) Handle pruning. | | |
| 3.e. | Explain the term Activation Record in stack allocation and List out the field included in Activation Record with their explanation . | (CO3, K2) | 6 |
| 3.f. | Consider the following sequence of three address codes : | | 6 |
| | 1. Prod := 0
2. I := 1
3. T1 := 4*I
4. T2 := addr (A) – 4
5. T3 := T2[T1]
6. T4 := addr (B) – 4
7. T5 := T4[T1]
8. T6 := T3*T5
9. Prod := Prod + T6
10. I = I + 1
11. If I <= 20 goto (3) | | |
| | Perform all types of optimization to following three address code. (CO4, K3) | | |
| 3.g. | Explain the different issues in the design of a code generator. | (CO5, K2) | 6 |

SECTION-C

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4. Answer any one of the following:-

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|------|---|-----------|----|
| 4-a. | Explain the term Tokens, Lexeme, Patterns in Lexical Analyzer. | (CO1, K2) | 10 |
| | Consider the following statement in C programming-
printf("i= %d, &i= %x", i, &i);
Count all the tokens generated by lexical analyzer in above statement. | | |
| 4-b. | Define Finite Automata. Differentiate Deterministic Finite Automata and Non-Deterministic Finite Automata with examples. | (CO1, K4) | 10 |

5. Answer any one of the following:-

- 5-a. Explain LALR parser. Write the Steps for constructing the LALR parsing table. 10
Construct LALR parsing table for the given grammar: (CO2, K3)
 $S \rightarrow L = R / R$
 $L \rightarrow *R / id$
 $R \rightarrow L$
 also Parse the String $id = id$ using LALR parser.
- 5-b. Explain SLR Parser. Write the steps for constructing SLR parsing table. Construct 10
SLR parsing table for the following grammar and parse the input string “ $id * id + id$ ”. (CO2, K3)
 $E \rightarrow E + T / T$
 $T \rightarrow T * F / F$
 $F \rightarrow (E) / id$
6. Answer any one of the following:-
- 6-a. Consider the following Syntax Directed Translation Scheme (SDTS). (CO3, 10
K3)
Using below SDTS, Construct parse tree and annotated parse tree for the expression: “ $S = 2 + 3 * 4$.”
 $E \rightarrow E + T \quad \{ E.val = E.val + T.val \}$
 $E \rightarrow T \quad \{ E.val = T.val \}$
 $T \rightarrow T * F \quad \{ T.val = T.val * F.val \}$
 $T \rightarrow F \quad \{ T.val = F.val \}$
 $F \rightarrow num \quad \{ F.val = num.lexval \}$
- 6-b. Define the term Symbol Table. List and explain the various data structures 10
commonly used for implementing a Symbol Table. (CO3, K3)
7. Answer any one of the following:-
- 7-a. Explain the term triple, indirect triple and quadruple. Generate three address code 10
for expression $a = (-c * b) + (-c * d)$ and represent that code in triple, indirect triple and quadruple form. (CO4, K3)
- 7-b. Explain following terms with the help of examples: (CO4, K3) 10
 a) Loop Jamming
 b) Loop Unrolling
 c) Code Motion
 d) Induction Variable Elimination
8. Answer any one of the following:-
- 8-a. Define Directed Acyclic Graph. Write the Algorithm for Construction of DAG. 10
For the following Basic Block , Construct DAG. (CO5, K2)
 $d = b * c;$
 $e = a * b;$
 $b = b + c;$
 $c = b * c;$
- 8-b. Explain the following terms: (CO5, K2) 10
 i. Dead Code Elimination
 ii. Constant folding
 iii. Common Sub Expression Elimination
 iv. Peephole Optimization

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