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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

M.Tech (Integrated)

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. Constructs the desired target program from the intermediate representation of the source program- (CO1,K1) 1
- (a) Analysis part
- (b) Lexical part
- (c) Synthesis part
- (d) None of these
- 1-b. Lexical analysis is about breaking a sequence of characters into _____. 1
- (CO1,K2)
- (a) Tokens
- (b) Lines
- (c) Groups
- (d) Packets
- 1-c. _____ function can be used to constructing transitions of the automaton in the parsing methods. (CO2,K2) 1
- (a) STATE
- (b) MOVE
- (c) CLOSURE
- (d) GOTO
- 1-d. Select the element needs to be incorporated into an LR (0) item in order to analyze 1

and transform it into an LR (1) item. (CO2,K2)

- (a) dollar
- (b) lookahead
- (c) start symbol
- (d) none of above

1-e. Postfix notation of $a + b * c$ is ____ . (CO3,k3) 1

- (a) abc^{*+}
- (b) $abc+^{*}$
- (c) $ba+c^{*}$
- (d) None of the above

1-f. The _____ is the pictorial representation of derivations. (CO3,K2) 1

- (a) The oct tree
- (b) Parse Tree
- (c) Binary Tree
- (d) None of the above

1-g. _____ is the most efficient data structure in the case of symbol table implementation has minimum access time. (CO4,K3) 1

- (a) Self-organizing list
- (b) Search tree
- (c) Hash table
- (d) linear list

1-h. `int a = "hello";` identify error in the given code. (CO4,K2) 1

- (a) Syntax error
- (b) Semantic error
- (c) Target code error
- (d) None of above

1-i. Structure preserving transformations on basic blocks are____-(CO5, K1) 1

- (a) Common sub-expression elimination
- (b) Dead-code elimination
- (c) Renaming of temporary variables
- (d) All the above

1-j. DAG representation of a basic block allows____. (CO5,K2) 1

- (a) Automatic detection of local common sub expressions
- (b) Automatic detection of induction variables
- (c) Automatic detection of loop variant instructions
- (d) None of the above

2. Attempt all parts:-

2.a. Define compile time,load time,run time in the language processing system.(CO1,K1) 2

- | | | |
|------|---|---|
| 2.b. | Differentiate between LR(0) and LR(1) Canonical items. (CO2,K3) | 2 |
| 2.c. | Define the term backpatching. (CO3,K1) | 2 |
| 2.d. | List out the goals of Error Handler. (CO4, K1) | 2 |
| 2.e. | Discuss the issues in the design of code generators. (CO5,K1) | 2 |

SECTION-B

30

3. Answer any five of the following:-

- | | | |
|------|---|---|
| 3-a. | Differentiate between a) Native compiler and Cross Compiler b) one pass compiler and multi pass compiler (CO1,K4) | 6 |
| 3-b. | Illustrate Compiler Construction Tools and Bootstrapping with example. (CO1,K2) | 6 |
| 3-c. | Define Types of conflict in the LR parsing table. How do you resolve conflicts in an LR parsing table. (CO2,K2) | 6 |
| 3-d. | Define shift reduce parser and its operations. consider the given grammar. (CO2,K4)
$S \rightarrow S + S$
$S \rightarrow S * S$
$S \rightarrow id$
Perform Shift Reduce parsing for input string "id + id + id" | 6 |
| 3.e. | Elaborate syntax directed translation scheme. and different forms of intermediate code. (CO3, K2) | 6 |
| 3.f. | Define and distinguish between static scope and dynamic scope with example. Briefly explain access to non-local Names in static scope. (CO4,K4) | 6 |
| 3.g. | Describe Peephole optimization with various techniques. (CO5,K2) | 6 |

SECTION-C

50

4. Answer any one of the following:-

- | | | |
|------|---|----|
| 4-a. | Define Regular Expression and its properties also Construct the NFA for the regular expression $bc(ab+c)^*a^+$ by using Thompson's construction methodology. (CO1,K4) | 10 |
| 4-b. | Define lexeme, Token and pattern with example also Illustrate the phases of compiler with following Expression $a = a + b * c * 2$ (CO1,K3) | 10 |

5. Answer any one of the following:-

- | | | |
|------|---|----|
| 5-a. | Construct CLR parsing table for the given grammar (CO2,K4)
$S \rightarrow AA$
$A \rightarrow aA$
$A \rightarrow b$
Convert that table into LALR parsing table. | 10 |
| 5-b. | Write down the algorithm for first and follow and Find out FIRST and FOLLOW sets of the given production rules. (CO2,K3)
$S \rightarrow aXZh$
$X \rightarrow cY$
$Y \rightarrow bY / \epsilon$
$Z \rightarrow EF$
$E \rightarrow g / \epsilon$
$F \rightarrow f / \epsilon$ | 10 |

6. Answer any one of the following:-

6-a. Differentiate between S- attributes and L- attributes. Translate the following expression into quadruple, triple, and indirect triple: $-(a+b)*(c+d)-(a+b+c)$. (CO3,K4) 10

6-b. Explain three address code Representation form with example and write the three-address code for the following program. (CO3,K3) 10

```
switch(i+j)
{
Case 1: x= y+z
Case 2: u= v+w
Default: p= q+r
}
```

7. Answer any one of the following:-

7-a. Define activation of procedure. How it can be represented with activation record and activation tree. Explain with quick sort example (CO4,K3) 10

7-b. Discuss the various Storage Management techniques available. What are their importance in compiler design.. (CO4,K2) 10

8. Answer any one of the following:-

8-a. Define the terms basic blocks, flow graphs and loop in flow graph also write the algorithm for partitioning of basic block. Generate the basic block and flow-graphs for the following expressions - (CO5,K4) 10

- 1) $r = 1$
- 2) $c = 1$
- 3) $t1 = 10 * r$
- 4) $t2 = t1 + c$
- 5) $t3 = 8 * t2$
- 6) $t4 = t3 - 88$
- 7) $a[t4] = 0.0$
- 8) $c = c + 1$
- 9) if $c \leq 10$ goto (3)
- 10) $r = r + 1$
- 11) if $r \leq 10$ goto (2)
- 12) $r = 1$
- 13) $t5 = c - 1$
- 14) $t6 = 88 * t5$
- 15) $a[t6] = 1.0$
- 16) $r = r + 1$
- 17) if $r \leq 10$ goto (13)

8-b. Discuss the following Optimization techniques with example. (CO5,K3) 10

- a) Frequency reduction
- b) Loop Unrolling
- c) Loop Fusion
- d) Dead code elimination
- e) Strength reduction

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