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BRAINWARE UNIVERSITY

Term End Examination 2025-2026

Programme – MCA-2024

Course Name – Compiler Design

Course Code - MCA40115A

(Semester IV)

Full Marks : 60

Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

- (i) Identify the primary objective of a compiler in program translation.
 - a) Execute source code
 - b) Translate source code to target code
 - c) Edit source code
 - d) Debug source code
- (ii) Identify the input provided to a compiler.
 - a) Object program
 - b) Machine code
 - c) Source program
 - d) Assembly code
- (iii) Identify the model that divides compilation into analysis and synthesis phases.
 - a) Waterfall model
 - b) Analysis-synthesis model
 - c) Incremental model
 - d) Spiral model
- (iv) Which option best describes the role of lexical analysis in compilation?
 - a) Generates target code
 - b) Builds parse tree
 - c) Groups characters into tokens
 - d) Performs optimization
- (v) Which statement correctly describes the function of syntax analysis?
 - a) Checks variable types
 - b) Verifies grammatical structure
 - c) Generates machine code
 - d) Removes redundancy
- (vi) Which option best describes the significance of the symbol table?
 - a) Stores machine code
 - b) Stores grammar rules
 - c) Stores identifiers and attributes
 - d) Stores tokens only
- (vii) Which statement best describes why compilers are divided into phases?
 - a) Increase code size
 - b) Simplify design and debugging
 - c) Reduce memory usage
 - d) Avoid syntax checking
- (viii) Given a regular expression, which method is first applied to build an automaton for token recognition?
 - a) Direct DFA construction
 - b) Thompson's construction

- c) DFA minimization
(ix) If an NFA has ϵ -transitions, which step is essential before DFA construction?
a) Token specification
c) Grammar elimination
(x) When multiple tokens match the same lexeme, which rule is typically applied by lexical analyzers?
a) Shortest match rule
c) Random selection
(xi) Which statement best analyzes why ambiguous grammars are problematic for parsers?
a) They increase parsing speed
c) They simplify grammar design
(xii) Which analysis determines where variables are live in a program?
a) Syntax analysis
c) Lexical analysis
(xiii) Which analysis correctly distinguishes local and global optimization?
a) Local uses CFG, global does not
c) Local requires registers, global does not
(xiv) Which option best analyzes the impact of data flow analysis on optimization correctness?
a) Ensures semantic preservation
c) Reduces grammar size
(xv) Which statement best analyzes why simple code generators are used in teaching compilers?
a) They are inefficient
c) They eliminate optimization
d) ϵ -closure computation
b) ϵ -closure computation
d) Code optimization
b) Longest match rule
d) First defined rule only
b) They cause multiple parse trees for the same string
d) They eliminate conflicts
b) Data flow analysis
d) Parsing
b) Global considers multiple basic blocks
d) Both are identical
b) Increases compilation speed only
d) Eliminates tokens
b) They clarify core concepts
d) They avoid registers

Group-B

(Short Answer Type Questions)

3 x 5=15

2. Define a compiler and state its primary function. (3)
3. Explain the role of lexical analysis in the compilation process. (3)
4. Analyze why a compiler is divided into multiple phases instead of a single phase. (3)
5. Given an input string and an LL(1) parsing table entry, show how the next production is selected during predictive parsing. (3)
6. Given the expression $x = (a + b) * (a + b) + c$, construct the DAG and evaluate the minimum number of machine instructions required after optimization. (3)

OR

A basic block has 6 live variables and only 3 registers. Design an optimal register allocation strategy and evaluate how many spill instructions are required. (3)

Group-C

(Long Answer Type Questions)

5 x 6=30

7. Explain the analysis-synthesis model of compilation with the help of a neat block diagram and description. (5)
8. Construct an NFA using Thompson's construction for the regular expression $(a|b)^*a$, clearly showing the number of states and ϵ -transitions. (5)
9. Given the syntax-directed definition with inherited attributes, analyze why some inherited attributes cannot be evaluated using pure bottom-up parsing. (5)
10. Using a given syntax-directed definition for expression evaluation, analyze the exact order of attribute computation during parsing. (5)

11. Given two grammars, analyze how grammar structure affects the size of LL(1) and LR parsing tables. (5)
12. Given the expression $y = (a + b) * (a + b) + (a + b)$, construct the DAG and evaluate the minimum number of computations required after optimization. (5)

OR

A DAG for a basic block has one root and six internal nodes representing arithmetic operations. Evaluate the minimum number of machine instructions required after optimization and justify your estimate. (5)

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