KATHMANDU UNIVERSITY
End Semester Examination
January/February, 2025

Marks Scored:

Level : B.E.
Year : IV

Course : COMP 409
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

21 FEB 2025

Registration No.:

Date :

SECTION "A"

[20Q. × 0.5 = 10 marks]

Choose the most appropriate answer and **encircle**.

1. Which of the following is not true about an interpreter?
   a. Interpreter analyses each source statement every time it is to be executed
   b. Interpreter is a kind of translator
   c. Interpreter generates an object program from the source program
   d. Appears to execute a resource as if it were machine language

2. In which phase the concept of Finite State Automata is used?
   a. Lexical analysis
   b. Parser
   c. Code Optimization
   d. Code generation

3. What is the relation between DFA and NFA on the basis of computational power?
   a. DFA is more powerful than NFA
   b. NFA is more powerful than DFA
   c. In some case DFA and in some case NFA
   d. Equally powerful

4. What is the primary purpose of a symbol table in a compiler?
   a. To store all the keywords of the programming language
   b. To store information about variables, functions and objects used in the program
   c. To store the output of the compiled code
   d. To store the source code

5. What is the number of tokens in the following c-statement?
   printf("x=%d, &x=%x", x, &x);
   a. 10
   b. 12
   c. 19
   d. 21

6. What is the ε-closure of a state in a NFA?
   a. The set of states reachable from the given state on any input symbol
   b. The set of states reachable form the given state using only ε-transitions
   c. The set of states reachable form the given state using only ε-transitions and one symbol
   d. The set of all states in the NFA

7. Which of the following language is not regular?
   a. L= {aaabbb}
   b. L= {bbbaaaa}
   c. L= { aabbaabb}
   d. L = { $a^n b^n$ | n ≥0}

8. A grammar is said to be ambiguous if
   a. It has more than one start symbol
   b. It has left recursive rule
   c. It generates an infinite language
   d. It generates more than one parse tree for same string

9. Which of the following types of parsing requires backtracking?
   a. LL(1) Parsing
   b. Shift-Reduce Parsing
   c. Recursive Descent Parsing
   d. Predictive Parsing

10. What does "LL" stand for in LL(1) parsing?
   a. Left-to-right scanning, Lookahead
   b. Leftmost derivation, left-to-right scanning
   c. Left-recursive, Lookahead
   d. Lookahead, Leftmost derivation

11. Bottom-up parsing is also known as
   a. Shift-Reduce Parsing
   b. Predictive Parsing
   c. Operator Precedence Parsing
   d. Recursive Descent Parsing

12. What is type coercion in type checking?
   a. Automatically converting one type to another
   b. Checking types at runtime
   c. Rejecting incorrect types during compilation
   d. Explicitly converting one type to another

13. Which of the following statements about parser is correct?
   a. LR(0) is more powerful than SLR
   b. Canonical LR is more powerful than SLR
   c. SLR is more powerful than LALR
   d. SLR is more powerful than Canonical LR

14. Which optimization technique is directly aided by DAG representation?
   a. Syntax error detection
   b. Code linking
   c. Register allocation
   d. Common subexpression elimination

Consider the following grammar

$$S \rightarrow XYB \mid ccb \mid YX$$
$$X \rightarrow xX \mid \varepsilon$$
$$Y \rightarrow yY \mid Xy \mid \varepsilon$$
$$B \rightarrow bbc \mid b$$

Question (15 to 16) are based on the given grammar

15. FIRST(S) is:
   a. {x, y, b }
   b. {c, x, y, b}
   c. {c, x, y, b, ε }
   d. {c, x, y, ε }

16. FOLLOW(Y) is:
   a. {b, x }
   b. {b, x, $}
   c. {b, x, y, $}
   d. { x, $}

17. In an L-attributed definition, inherited attributes can be computed using:
    a. Sibling nodes' attributes only
    b. Parent nodes' attributes only
    c. Parent and left sibling nodes' attributes
    d. Any node in the parse tree

18. Determination of exactly which register to place a given variable is called
    a. Register allocation
    b. Register assignment
    c. Memory allocation
    d. Variable assignment

19. Dead code elimination is a technique used to
    a. Increase register usage
    b. Reduce loop iterations
    c. Optimize function calls
    d. Remove unreachable or unnecessary code

20. What is the primary benefit of using Constant Folding during compilation?
    a. Reduces memory usage
    b. Increase the speed of parsing
    c. Reduces the time taken to compute expressions at runtime
    d. Reduce the size of the source code

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SECTION "B"
[6 Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. What is compiler? Explain the purpose of dividing the compiler in analysis and synthesis phase.

2. Illustrate the importance of finite automata in compiler design.

3. Explain which parser is widely used in compiler nowadays. Also, differentiate between top-down and bottom up parsing.

4. Give the importance of syntax directed translation scheme. Differentiate between L-attributed and S-attributed grammar.

5. Explain the role of type checker? Explain about static and dynamic type checking.

6. Differentiate between DAG and syntax tree. construct syntax tree and DAG for the expression
$a + a * (b - c) + (b - c) * d$

7. Write short notes on
   a. Cousins of compiler
   b. Symbol table

SECTION "C"
[2 Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Write the algorithm for the construction of canonical collection of LR(1) item. Construct the parsing table and find whether the given grammar is SLR(1) or CLR(1). Give proper justification.

   S → Aa | bAc | Bc | bBa
   A → d
   B → d

9. Write the steps to compute *firstpos, lastpos, followpos* for the given regular expression a(a | b)*bba. Convert the same regular expression to DFA by direct method.

10. Write the advantages of code optimization. Also explain different types of optimization used with proper example.