KATHMANDU UNIVERSITY
End Semester Examination [C]
November/December, 2023

Marks Scored:

Level : B.Sc.
Year : III
Course : COMP 409
Semester : II

Exam Roll No. :
Time: 30 mins.
F. M. : 10

Registration No.:
Date 28 NOV 2023

SECTION "A"

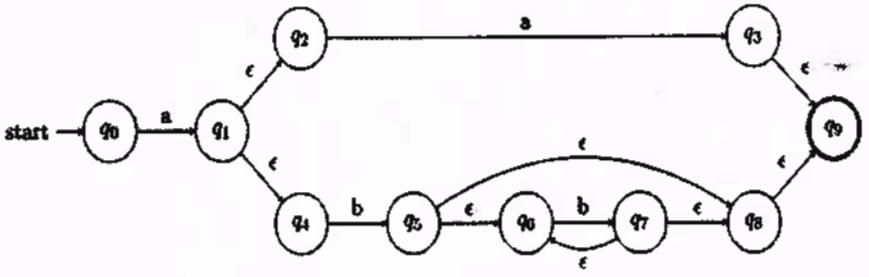
[20 Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate option.

1. Which of the following is also called the frontend of compiler
   a. Code Optimization
   b. Loader and Linker
   c. Analysis Part
   d. Synthesis Part

2. The sequence of characters matched by a pattern to form the corresponding token or a sequence of input characters that comprises a single token is called a .....
   a. Lexeme
   b. Syntax Analyzer
   c. Code Optimization
   d. Synthesis Part

3. Epsilon closure of q_7 is



   a. {q6, q9, q5, q8}
   b. {q6, q7, q8, q9}
   c. {q6, q9, q5, q8, q7}
   d. {q5, q6, q7, q8, q9, q3}

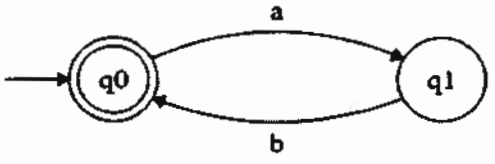
4. Which of the following regular expressions denotes a language comprising all possible strings of odd length over the alphabet (0, 1)?
   a. (00|01|11|10)* b. (01|10) (00|11)* c. (0|1)(0|1) d. (0|10)*

5. A language is regular if and only if
   a. accepted by DFA
   b. accepted by PDA
   c. derived from CFG
   d. accepted by Turing machine

6. Number of token in the C-expression *printf("%d",a);* is
   a. 10 b. 7 c. 8 d. 9

7. Which of the following is a string produced by CFG given by production
$S \rightarrow a \mid aAS$
$A \rightarrow bS$
a. abaabab b. ababbba c. abaabaa d. babaabaa

8. Language accepted by the following NFA with $\sum = \{a,b\}$ is
a. $L = \{ a^m b^n \mid n,m \geq 0\}$
b. $(a|b)^*$
c. $L = \{ a^n b^n \mid n \geq 0\}$
d. $L = \{ a^n b^m \mid n \geq 1, m \geq 0\}$



9. A bottom up parser generates
a. Right most derivation b. Left most derivation in reverse
c. Left most derivation d. Right most derivation in reverse

10. Which of the following phase of compiler checks the grammar of the programming?
a. Semantic Analysis b. Code Generation
c. Code Optimization d. Syntax Analysis

11. Type checking is normally done during
a. Syntax directed translation b. Syntax analysis
c. Lexical analysis d. Code optimization

12. Which of the following parser require canonical collection of LR(1) item?
a. Recursive Descent Parser b. SLR
c. LALR(1) d. LR(0)

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 one of the following kinds of derivation is used by LR?
a. Leftmost in reverse b. Rightmost
c. Leftmost d. Rightmost in reverse

Consider the following grammar

$S \rightarrow ACB \mid CbB \mid Ba$
$A \rightarrow da \mid BC$
$B \rightarrow g \mid \varepsilon$
$C \rightarrow h \mid \varepsilon$

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

15. FIRST(A) is:
a. {a,b,d,g,h} b. {a,b,d,g,h,ε} c. {d,g,h,b} d. { d,g,h,ε}

16. FOLLOW(C) is:
a. {$,g,h,a} b. {g, $,b,a,h} c. {$,h,g} d. { $}

17. In Syntax directed translation we associate _____ to the grammar
a. syntax b. production c. semantic d. attribute

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

19. Peep-hole optimization is a form of
a. Constant Folding
b. Local Optimization
c. Loop Optimization
d. Data Flow Analysis

20. The following code is an example of?

```
void add(int x)
{
        return x+10;
        printf("value of x is %d", x);
}
```

a. Flow of control optimization
b. Redundant instruction elimination
c. Unreachable code
d. Constant Folding

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SECTION "B"
[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. What is compiler? Explain the function of each phase in brief.

2. Illustrate the importance of regular expression in lexical analysis phase.

3. Explain non-recursive predictive parsing with diagram. Compute FIRST and FOLLOW for the following grammar:

   S→ A

   A→ aB | Ad

   B→ bBc | f

   C →g

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

5. What is type checking? Explain about static and dynamic type checking.

6. Explain the need of code-optimization. Illustrate with example about the global transformation.

7. Write short notes on
   a. Activation tree
   b. Kernel and non-kernel items

SECTION "C"
[2 Q × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Write the algorithm for the construction of canonical collection of LR(0)item. Prove the statement "Every SLR (grammar) is unambiguous but every unambiguous grammar cannot be solved by SLR parsing" using the following grammar.

   S → L = R
   S→ R
   L → *R
   L → id
   R→L

9. Write the steps to compute *firstpos, lastpos, followpos* for the given regular expression. Convert the regular expression (a | b)* + (a | c)* to DFA directly.

10. Consider the following grammar and give the syntax directed definition to construct parse tree. For the input expression 5*3+4*9, construct an annotated parse tree along with dependency graph according to your syntax directed definition.

$E \rightarrow TE'$
$E' \rightarrow +TE'$
$E' \rightarrow \varepsilon$
$T \rightarrow FT'$
$T' \rightarrow *FT'$
$T' \rightarrow \varepsilon$
$F \rightarrow$ digit