KATHMANDU UNIVERSITY
End Semester Examination
June/July, 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 : 18 JUL 2023

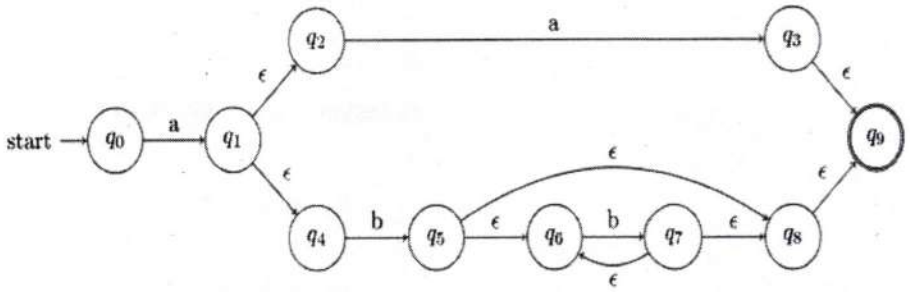
SECTION "A"
[20 Q. × 0.5 = 10 marks]

Mark [X] the most appropriate answer.

1. Which of the following is also called the backend of compiler?
   a. Lexical Analyzer
   b. Loader and Linker
   c. Code Generator
   d. Synthesis Part

2. Scanning is also called
   a. Lexical Analyzer
   b. Syntax Analyzer
   c. Analysis Part
   d. Synthesis Part

3. Epsilon closure of q_5 is
   a. $\{q_6, q_9, q_5, q_8\}$
   b. $\{q_6, q_9, q_5, q_8, q_3\}$
   c. $\{q_6, q_9, q_5, q_8, q_7\}$
   d. $\{q_5, q_6, q_7, q_8, q_9, q_3\}$

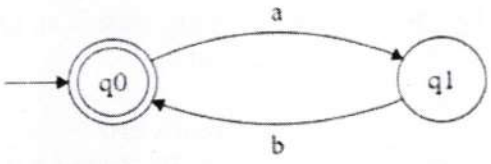


4. Which of the following regular expressions denotes a language comprising all possible strings of even length over the alphabet (0, 1)?
   a. (0|10)* b. (01|10) (0|1)* c. (0|1)(0|1)(0|1)* d. (00|01|11|10)*

5. Number of token in the C-expression printf("i=%d, j=%f, &i=%x\n",i,j,&i); is
   a. 30 b. 12 c. 10 d. 14

6. Which of the following is a string produced by CFG given by production?
   $S \rightarrow 0 \mid 0AS$
   $A \rightarrow 1S$
   a. 0100101 b. 0101110 c. 0100100 d. 10100100

7. 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. $L = \{ a^n b^m \mid n \geq 1, m \geq 0\}$



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

9. 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

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

11. Which of the following is a top-down parser?
   a. Recursive Descent Parser
   b. SLR
   c. LALR(1)
   d. LR(0)

12. 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

13. 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 (14 and 15) are based on the given grammar.

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

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

16. A parse tree showing the value of attributes at each node is
   a. Semantic tree
   b. Syntax tree
   c. Annotated parse tree
   d. Phrase marker

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 allocation
   b. Register assignment
   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? Illustrate the translation of the statement A := B*C+D/10 on all the phases of compiler.

2. Convert the regular expression (a | b)*abb to DFA directly.

3. Write the algorithm to compute FIRST and FOLLOW. Compute FIRST and FOLLOW for the following grammar:
   S→ A
   A→ aB | aC | Ad | Ae
   B→ bBc | f
   C →g

4. What is syntax directed translation scheme? Also explain about different forms of intermediate code with suitable example of your choice.

5. What is symbol table? Illustrate the use of symbol table and error handler during compilation.

6. Explain the need of code-optimization. Illustrate with example about the local transformation on the basic blocks.

7. Write short notes on:
   a. Type checking
   b. Kernel and non-kernel items

SECTION "C"
[2Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Write the algorithm for the construction of SLR parsing table. 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. Construct the LALR(1) and CLR(1) parsing table for the following grammar and compare them:

$E \rightarrow TT$

$T \rightarrow tT \mid e$

10. Write the block construction algorithm. Also explain about flow graph and loop. Partition the following code into basic blocks and find the blocks number. [2+1+1+4]

a) I=1
b) J=1
c) T1=10*I
d) T2 = T1+J
e) T3=8*T2
f) T4= T3-88
g) A[T4]=0.0
h) J=J+1
i) If J<=10 goto(c)
j) I = I+1
k) If I <=10 goto(b)
l) I=1
m) T5=I-1
n) T6=88*T5
o) A[T6]=1.0
p) I = I+1
q) If I<10 goto(m)