KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Marks Scored:

Level : B.Sc.
Year : III

Course : COMP 409
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No. :

Date : June - 19, 2022

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Encircle the most appropriate answer among the given choices.

1. A compiler that translates source code into hardware instruction is called
   a. Native Code Compiler
   b. JIT Compiler
   c. Pure Interpreter
   d: Virtual Machine Compiler

2. Positive closure $\sum^+$ is
   a. $\sum$ b. $\sum^*$ c. $\sum^* + \sum^0$ d. $\sum^* - \sum^0$

3. The regular expression having all strings in which any number of 0's is followed by exactly two 1's followed by any number of 2's is
   a. (0+11+2)* b. (0+11)*2* c. 0* + 11 + 2 d. 0*112*

4. What is the output of lexical analyzer?
   a. String Character b. A set of RE c. Set of Tokens d. Syntax Tree

5. Which of the following does the given NFA of Figure 1 represent?
   a. [A] {11, 101} * {01}
   b. [B] {110, 01} * {11}
   c. [C] {11, 110} * {0}
   d. [D] {00, 110} * {1}

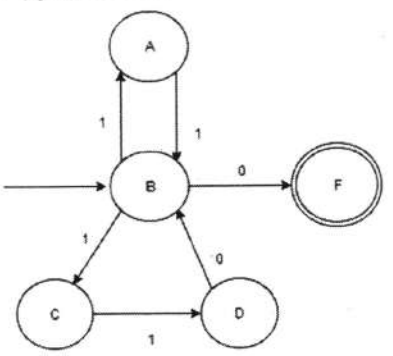

Figure 1

6. Given the language L = {ab, aa, baa}, which of the following strings are in L*?
   1) abaabaaabaa
   2) aaaabaaaa
   3) baaaaabaaaab
   4) baaaaabaa
   a. 1, 2 and 3 b. 2, 3 and 4 c. 1, 2 and 4 d. 1, 3 and 4

7. A language is regular if and only if
   a. accepted by DFA
   b. accepted by PDA
   c. accepted by LBA
   d. accepted by Turing machine

8. In the class of LR(k) grammar, LR(k) means
   a. Left to right scan, Right most derivation, no input symbol lookahead.
   b. Left to right scan, Left most derivation, k input symbols lookahead.
   c. Left to right scan, Right most derivation, k input symbols lookahead.
   d. Left to right scan, Right most derivation in reverse, k input symbols lookahead

9. For predictive parsing the grammar A → AA | (A) | ε is not suitable because
   a. The grammar is left recursive
   b. The grammar is ambiguous
   c. The grammar is right recursive
   d. The grammar is operator grammar

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

Consider the following grammar

E → TE'
E' → +TE' | ε
T → FT'
T' → *FT' | ε
F → (E) | id

Question (11 to 13) are based on the given grammar

11. FIRST(E') is
   a. {+, ε} b. {+,), $} c. {*, ε } d. { (, id}

12. FOLLOW(T) is
   a. {+, ε } b. {+,), $} c. {*, ε } d. { (, id}

13. FOLLOW(E) is
   a. {+, ε } b. {+,), $} c. {*, ε } d. {), $}

14. What is the similarity between LR, LALR and SLR?
   a. Same parsing table, but different algorithm
   b. Use same algorithm, but different parsing table
   c. Both parsing table and algorithm are different
   d. Their parsing table and algorithm are similar but uses top down approach

15. A shift reduce parser carries out the actions specified within braces immediately after reducing with the corresponding rule of grammar

   S → xxW (PRINT "1")
   S → y (PRINT "2")
   W →Sz (PRINT "3")

   What is the translation of xxxxyzz using the syntax directed translation scheme described by the above rules?
   a. 23131 b. 23132 c. 11233 d. 33211

16. Reduction in strength means
   a. Replacing run time computation by compile time computation
   b. Removing loop invariant computation
   c. Removing common sub expression
   c. Replacing a costly operation by a relatively cheaper one

17. Three address code involves
   a. Exactly 3 address
   b. At most 3 address
   c. No unary operators
   d. None of these

18. An intermediate code form is
    a. Postfix notation
    b. Syntax tree
    c. Three address code
    d. All of these

19. Which of the following is not a loop optimization?
    a. Copy propagation
    b. Loop fusion
    c. Loop unrolling
    d. None of these

20. Consider the following codes, on the left is original and on the right is after optimization.

Before	After
r7 = 4 + 1	r7 = 5
r5 = 2 * r4	r5 = 2 * r4
r6 = r5 * 2	r6 = r4 * 4

This is an example of,
    a. constant folding
    b. copy propagation
    c. constant combining
    d. Both a and c

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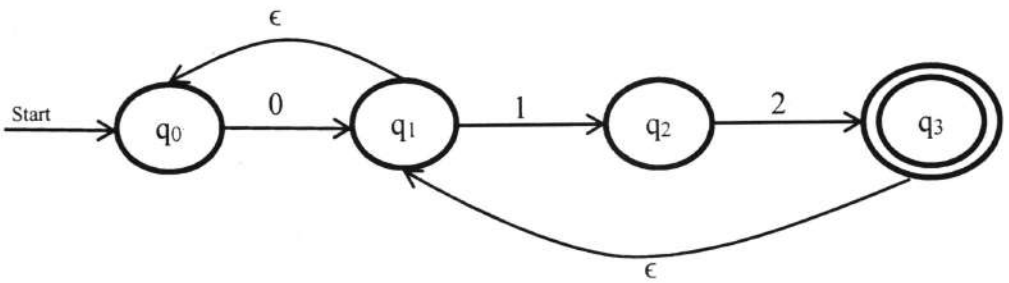
SECTION "B"
[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Draw the block diagram of compiler. Explain different steps in analysis phase. [1+3]

2. Construct DFA equivalent to following NFA. [4]



3. Write the steps involved in shift-reduce parsing. Design Shift-reduce parser for the following grammar G using the input string w = **10201** [2+2]

G: S →0S0 | 1S1 | 2

4. What is ambiguity? Show that the following grammar is ambiguous. [1+3]

S → a
S → abSb
S → aAb
A → bS
A → aAAb

5. Describe about syntax directed translation. Write syntax directed translation to convert infix expression to postfix expression [2+2]

6. What is type checking? Explain about static and dynamic type checking. [1+3]

7. Explain the need of code-optimization. Illustrate with example the loop-optimization. [1+3]

SECTION "C"
[2Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Write the procedure for converting regular expression to DFA by direct method. Convert the regular expression (a | b)*abb to DFA directly. [3+5]

9. Prove the statement "Every SLR (grammar) is unambiguous but every unambiguous grammar cannot be solved by SLR parsing" using the following grammar. [8]

1. S → L = R
2. S→ R
3. L → *R
4. L → id
5. R→L

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)