

KATHMANDU UNIVERSITY  
End Semester Examination  
February/March, 2019

Marks Scored:

Level : B. E./B. Sc.  
Year : IV/III

Course : COMP 409  
Semester : I/II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No. :

Date 10 :MAR 2019

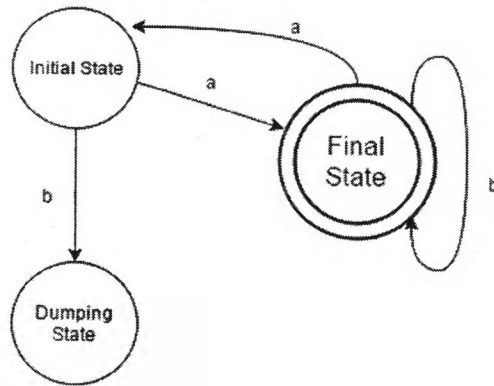
SECTION "A"

[20Q × 0.5 = 10 marks]

Tick (✓) the best answer(s) or fill in the blanks with most appropriate word/phrase.

- Programming that uses a form of symbolic logic as a programming language is often called.....  
[A] Imperative Language [B] Declarative Language  
[C] Functional Language [D] Object-oriented Language
- ..... not only performs the text-creation and modification functions of an ordinary text editor, but it also analyzes the program text.  
[A] Structure Editors [B] Pretty Printers [C] Static Checkers [D] Interpreters
- During..... the stream of characters making up the source program is read from left-to-right and grouped into tokens.  
[A] Linear Analysis [B] Hierarchical Analysis  
[C] Semantic Analysis [D] Syntax Analysis
- Positive closure  $\Sigma^+$  is  
[A]  $\Sigma$  [B]  $\Sigma^*$  [C]  $\Sigma^* - \Sigma^0$  [D]  $\Sigma^* + \Sigma^0$
- The language which is generated by the grammar  $S \rightarrow aSa \mid bSb \mid a \mid b$  over the alphabet  $\{a,b\}$  is the set of  
[A] All odd and even length palindromes  
[B] All even length palindrome  
[C] String that begins and end with the different symbol  
[D] All odd length palindromes
- For predictive parsing the grammar  $A \rightarrow AA \mid (A) \mid \epsilon$  is not suitable because  
[A] The grammar is right recursive [B] The grammar is ambiguous  
[C] The grammar is left recursive [D] The grammar is operator grammar
- The regular expression for the set of strings of 0's and 1's whose third symbol from the right end is 1.  
[A]  $(0+1)^*11(0+1)$  [B]  $(0+1)^*1(0+1)(0+1)^*$   
[C]  $(0+1)(0+1)1(0+1)^*(0+1)$  [D]  $(0+1)^*1(0+1)(0+1)$

8. Which of the following will not be accepted by the following finite automata?



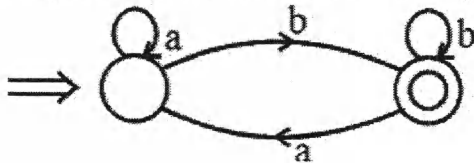
- [A] abaabbbbaabb [B] abaabbbbaabbaa [C] abaabaabbaab [D] abaabbbbab

9. 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

10. The regular expression for the following DFA is



- [A]  $ab^*(b + aa^*b)^*$  [B]  $a^*b(b + aa^*b)^*$  [C]  $a^*b(b^* + aa^*b)$  [D]  $a^*b(b^* + aa^*b)^*$

11. Shift reduce parser announces successful completion of parsing if action is

- [A] Shift [B] Accept [C] Reduce [D] Error

Consider the following grammar

$$\begin{aligned}
 S &\rightarrow ACB \mid CbB \mid Ba \\
 A &\rightarrow da \mid BC \\
 B &\rightarrow g \mid \epsilon \\
 C &\rightarrow h \mid \epsilon
 \end{aligned}$$

Question (12to 13) are based on the given grammar

12. FIRST(S)

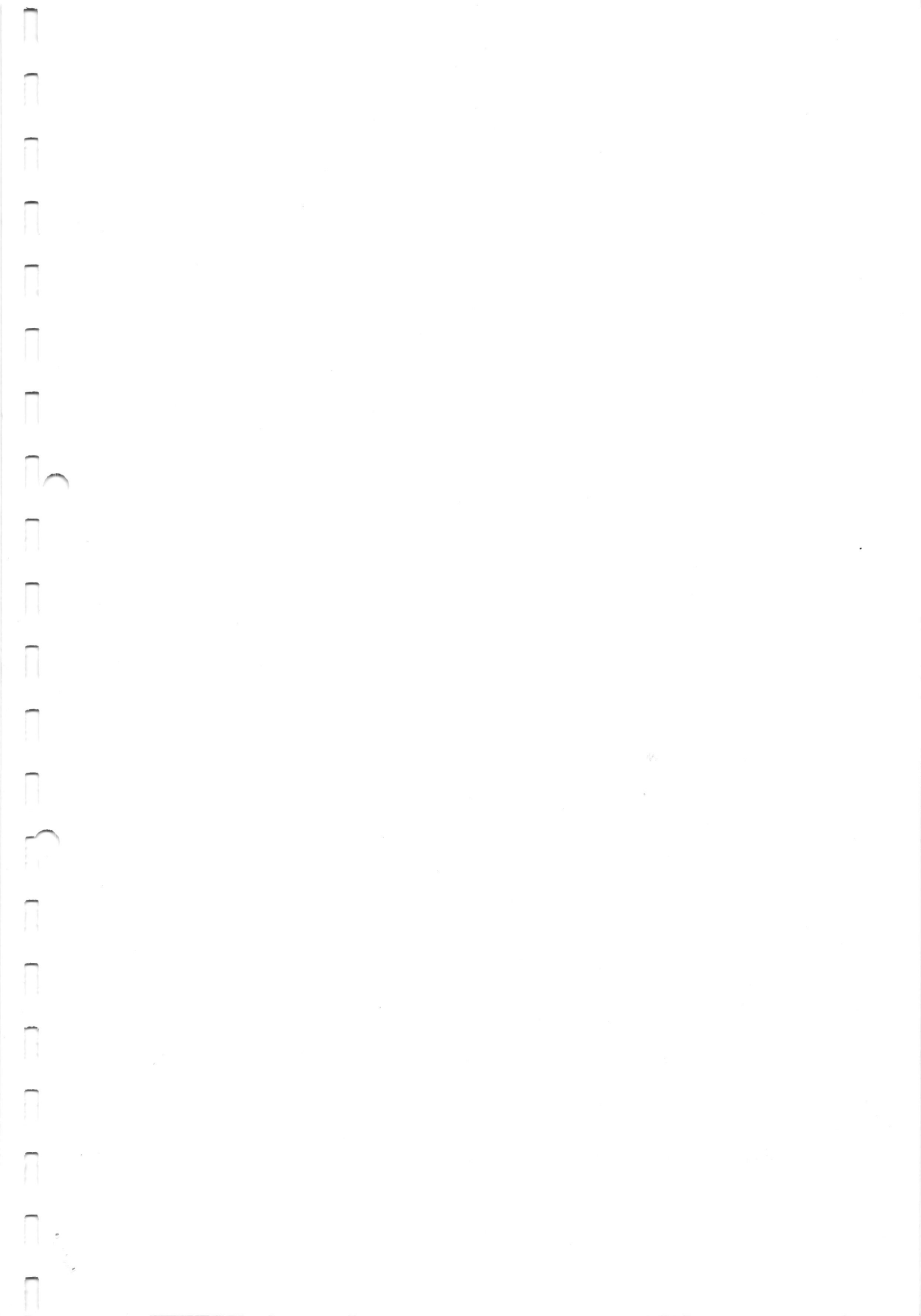
- [A] {d,g,h,b,a} [B] {d,g,h,ε,b,a} [C] {d,g,h, b} [D] {d,g,h,ε, b}

13. FOLLOW(B)

- [A] {g,\$,a,b,h} [B] {g,\$,a,b} [C] {g,\$,b,h} [D] {g,h,a, \$}

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14. Consider the following grammar  
 $S \rightarrow Aa \mid bAC \mid dC \mid bda$   
 $A \rightarrow d$   
[A] The grammar is not LL(1) [B] The grammar is LR(0)  
[C] The grammar is not LL(1) but SLR(1) [D] The grammar is SLR(1) only
15. Consider the following grammar  
 $S \rightarrow AaAb BbBa$   
 $A \rightarrow \epsilon$   
 $B \rightarrow \epsilon$   
[A] The grammar is not LL(1)  
[B] The grammar is LR(0)  
[C] The grammar is LL(1) but not SLR(1)  
[D] The grammar is not LALR(1) but CLR(1)
16. A shift reduce parser carries out the actions specified within braces immediately after reducing with the corresponding rule of grammar  
 $S \rightarrow xxW$  (PRINT "1")  
 $S \rightarrow y$  (PRINT "2")  
 $W \rightarrow Sz$  (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
17. When is the type checking usually done?  
[A] During syntax analysis [B] During lexical analysis  
[C] During code optimization [D] During syntax directed translation
18. Optimization of program that works within a single block is called  
[A] Global optimization [B] Local optimization  
[C] Loop controlling [D] Loop un-controlling
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. A compiler uses a two-pass scheme of translation, performing analysis of the source program in the first pass, and synthesis of the target program in the second pass. Clearly explain what use is made of the symbol table in the two passes of the compiler.
2. Construct a NFA for the regular expression  $(a|b)^*ab$ . Convert this NFA into an equivalent DFA.
3. Give the DFA for languages of strings over  $\{0,1\}$  in which
  - a. Each string ends with 00.
  - b. The set of all string whose third last symbol is 1
4. How will you determine, with the help of parse tree, that the given grammar is ambiguous? Explain with example.
5. What is type checking? Explain about static and dynamic type checking.
6. Explain the importance of transformations on basic blocks in code generation and optimization. Also explain each phase of local transformation with suitable example.
7. Write short notes on
  - a. Regular expression
  - b. Union operation on items
  - c. Inherited attributes
  - d. Type systems

SECTION "C"

[2Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Consider the grammar [2+2+4]
$$\begin{aligned} \text{lexp} &\rightarrow \text{atom} \mid \text{list} \\ \text{atom} &\rightarrow \mathbf{number} \mid \mathbf{identifier} \\ \text{list} &\rightarrow (\text{lexp-seq}) \\ \text{lexp-seq} &\rightarrow \text{lexp-seq lexp} \mid \text{lexp} \end{aligned}$$
  - a. Remove the left recursion
  - b. Construct First and Follow sets for the resulting grammar
  - c. Construct the LL(1) parsing table for the resulting grammar.

9. Discuss the algorithm for computation of the sets of LR(1) items. Also show that the following grammar is LR(1) but not LALR(1) [ 2+3+3]
- $$S \rightarrow Aa \mid bAc \mid Bc \mid bBa$$
- $$A \rightarrow d$$
- $$B \rightarrow d$$
10. Explain about syntax-directed definition and dependency graph. Consider the following syntax-directed definition and construct an annotated parse tree for input expression  $(4*7+1)*2$ , along with dependency graph. [2+2+2+2]

Production	Semantic Rule
$L \rightarrow En$	print(E.val)
$E \rightarrow E_1 + T$	$E . \text{val} := E_1 . \text{val} + T . \text{val}$
$E \rightarrow T$	$E . \text{val} := T . \text{val}$
$T \rightarrow T_1 * F$	$T . \text{val} := T_1 . \text{val} \times F . \text{val}$
$T \rightarrow F$	$T . \text{val} := F . \text{val}$
$F \rightarrow (E)$	$F . \text{val} := E . \text{val}$
$F \rightarrow \text{digit}$	$F . \text{val} := \text{digit} . \text{lexval}$