

Marks Scored:

KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2018

Level : B. Sc.
Year : III

Course : COMP 316
Semester : I

Exam Roll No. : Time: 30 mins.

F. M. : 10

Registration No. :

Date : MAR 19 2018

SECTION "A"

[20 Q × 0.5 = 10 marks]

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

- If $x = uvv$ be a string, what is v ?
[A] Empty String [B] Suffix of x
[C] Prefix of x . [D] Concatenation of String
- The problems that can be solved by computers are called
[A] Intractable [B] Decidable
[C] NP-complete [D] Hamilton-Circuit Problem
- The regular expression with all strings of 0's and 1's with at least two consecutive 0's is
[A] $(0+1)^*00(0+1)^*$ [B] $1+(10)^*$ [C] $(0+1)^*011$ [D] $0^*1^*2^*$
- Which of the following is NOT the set of regular expression $R = (01+011)^*1101$?
[A] 010111101 [B] 011101 [C] 01011011101 [D] 010101101
- Regular expression $(x|y)(x|y)$ denotes the set
[A] $\{xy,xy\}$ [B] $\{x,y\}$ [C] $\{x,y,xy\}$ [D] $\{xx,xy,yx,yy\}$
- Palindromes can't be recognized by any Finite State Machine because
[A] an FSM can remember arbitrarily large amount of information.
[B] an FSM can fix the mid-point.
[C] FSM can't find whether the second half of the string matches the first half.
[D] FSM can store the information
- Which of the following regular expressions corresponds to the production grammar
 $S \rightarrow XY | XS$
 $X \rightarrow a | aX$
 $Y \rightarrow b$
[A] $(ab)^*$ [B] $a(ab)^*b$ [C] aa^*b^+ [D] aa^*b
- Which of the following sentence is generated by production grammar?
 $S \rightarrow aSbX | b$
 $X \rightarrow dccX | d$
[A] aabbdccdbd [B] aabbdccdbb [C] ababbdccbb [D] dccabbd

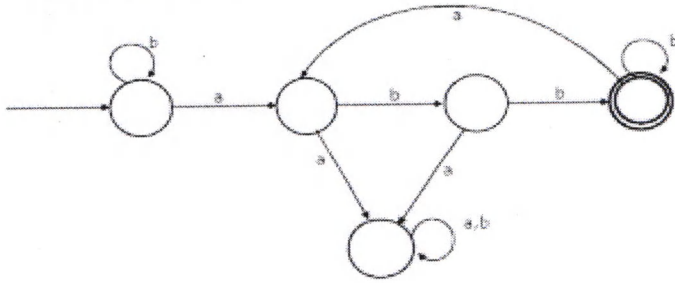
9. If L, M, N are any regular language then,
 [A] $L(M \cup N) = LM \cup LN$ [B] $L(M \cup N) = LM \cap LN$
 [C] $L(M \cap N) = LM \cup LN$ [D] $L(M \cap N) = LM \cap LN$
10. Which of the following is true for $A \rightarrow A\beta \mid \alpha$
 [A] $A \rightarrow \beta A'$ [B] $A \rightarrow \alpha A'$ [C] $A \rightarrow \alpha \beta$ [D] $A \rightarrow \beta A' \mid \alpha A'$
 $A' \rightarrow \alpha A' \mid \epsilon$ $A' \rightarrow \beta A' \mid \epsilon$ $A' \rightarrow \beta A' \mid \alpha$ $A' \rightarrow \epsilon$
11. Which of the following statement is true?
 [A] All languages can be generated by CFG
 [B] The number of symbols necessary to simulate a Turing Machine (TM) with m symbols and n states is mn .
 [C] Any regular language has an equivalent CFG.
 [D] The class of CFG is not closed under union.
12. Consider the production of the grammar
 $S \rightarrow TT$
 $T \rightarrow aa$
 $T \rightarrow bb$
 Which of the following language is produced by the above grammar
 [A] $L = \{aaaa, aabb, bbaa, bbba\}$ [B] $L = \{aaaa, aabb, bbaa, bbbb\}$
 [C] $L = \{aaaa, abab, bbaa, bbba\}$ [D] $L = \{aaaa, aabb, bbaa, baba\}$
13. Can a DFA simulate NFA?
 [A] No [B] Yes
 [C] Sometimes [D] Depends on NFA
14. The logic of pumping lemma is a good example of
 [A] The pigeon-hole principle [B] The divide and conquer technique
 [C] Recursion [D] Iteration

Following three questions (15-17) are based on the following grammar G

$G :$ $S \rightarrow syZ \mid XyzZ$
 $X \rightarrow Xz \mid xYZ$
 $Y \rightarrow yYy \mid XZ$
 $Z \rightarrow Zy \mid z$

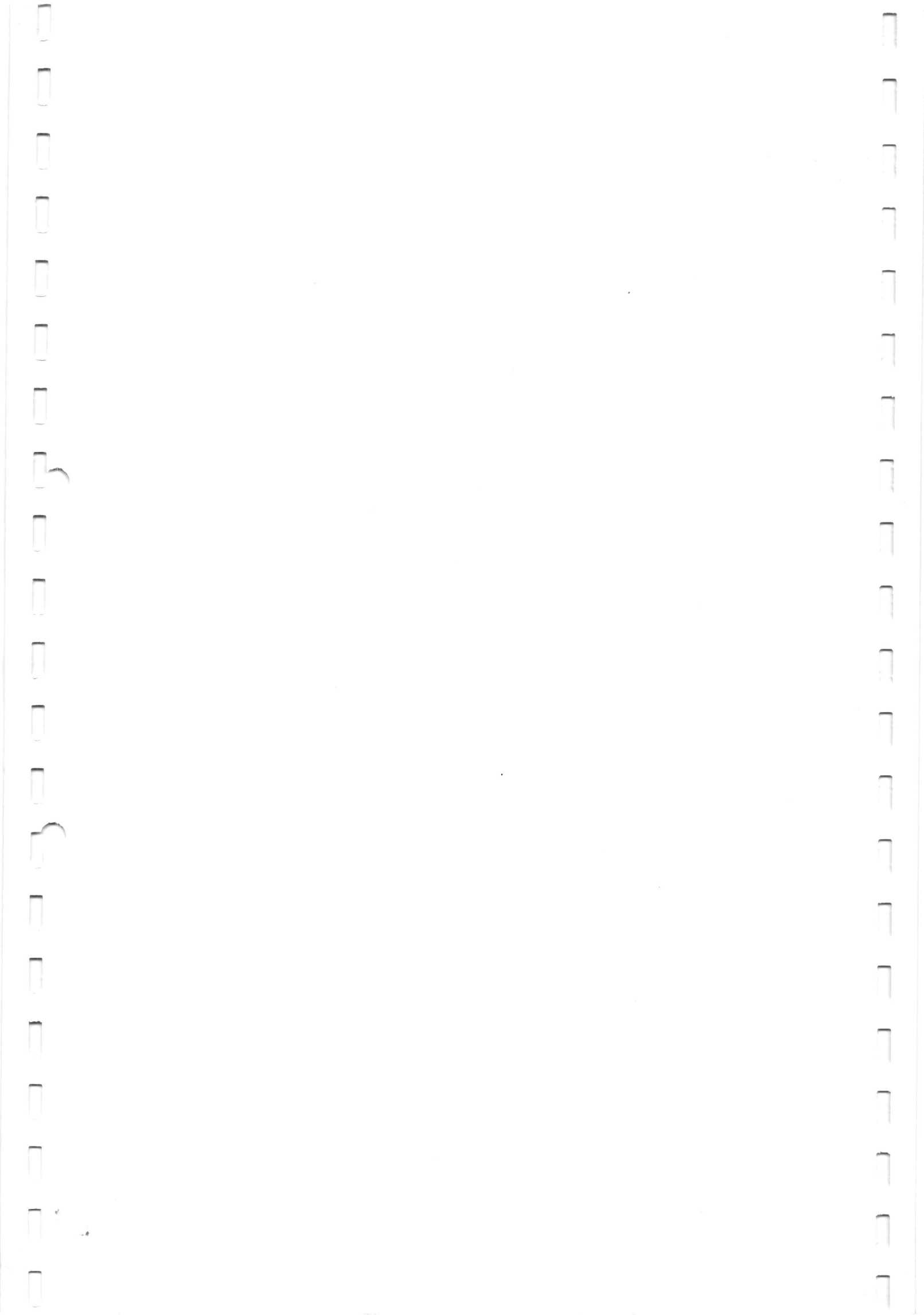
15. The generating variables of the given grammar are:
 [A] $Z, Y,$ [B] Z, S [C] X, Y [D] S, Y
16. The non-reachable symbol are
 [A] X, Y, Z [B] Y, Z [C] Y, X [D] S, X
17. After simplification, useful symbol in the grammar would be
 [A] $S \rightarrow syZX \rightarrow XzZ \rightarrow Zy \mid z$ [B] $S \rightarrow XyzZ \ X \rightarrow XzZ \rightarrow Zy \mid z$
 [C] $S \rightarrow syZ \quad Z \rightarrow Zy$ [D] $S \rightarrow syZ \quad Z \rightarrow Zy \mid z$

18. Consider the machine M



The language recognized by M is:

- [A] $\{w \mid \{a,b\}^* \text{ every } a \text{ in } w \text{ is followed by exactly two } b\text{'s}\}$
 [B] $\{w \mid \{a,b\}^* \text{ every } a \text{ in } w \text{ is followed by at least two } b\text{'s}\}$
 [C] $\{w \mid \{a,b\}^* w \text{ contains the substring 'abbb'}\}$
 [D] $\{w \mid \{a,b\}^* w \text{ does not contain 'aa' as substring}\}$
19. A Turing machine that is able to simulate other Turing machines is
 [A] Universal Turing Machine [B] Counter Machine
 [C] Nested Turing Machine [D] Finite Automata
20. Which of the following a Turing Machine does not consist of?
 [A] Input tape [B] Stack
 [C] Head [D] Blank symbol



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SECTION "B"

[6Q. × 4 = 24 marks]

Attempt ANY SIX questions.

1. Define Finite automata with example. How does DFA differs than NFA?
2. 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.
3. What is regular language? What are different regular operators? Explain with example.
4. Define the term Parse tree, regular grammar context free grammar and ambiguous grammar.
5. Remove ϵ -productions for each of grammar
$$\begin{aligned} S &\rightarrow AB \\ A &\rightarrow aAA \mid \epsilon \\ B &\rightarrow bBB \mid \epsilon \end{aligned}$$
6. Give the formal definition of TM. How does it differs than PDA?
7. Give a RE for the following languages:
 - a. $L = \{S \mid S \in \{a,b\}^* \text{ and } S \text{ starts with } aa \text{ and does not contains substring } bb\}$
 - b. $L = \{S \mid S \in \{0,1\}^* \text{ and } S \text{ is a string either begin or end (or both) with } 01\}$

SECTION "C"

[2 Q × 8 = 16 marks]

Attempt ANY TWO questions.

8. State pumping lemma for regular expression. Prove that $L = \{0^n 1^n \mid n \geq 0\}$ is not a regular language using pumping lemma.
9. Prove that for any NFA N accepting a language L there exists a DFA D accepting the same language L i.e. $L(N) = L(D)$.
10. Design a Turing Machine with input alphabet $\{0,1\}$ that, given a bit string as input, replaces the first tow 1's on the tape with 0's and do not change any of the other symbols on the tape.

