

Marks Scored:

KATHMANDU UNIVERSITY
End Semester Examination [C]
June, 2018

Level : B. Sc.
Year : III

Course : COMP 316
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No. :

Date **JUN: 12 2018**

SECTION "A"
[20 Q × 0.5 = 10 marks]

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

1. Finite state machine can recognize
[A] Any grammar [B] Only CFG
[C] Any unambiguous grammar [D] Only regular grammar
2. Give a production grammar for the language
 $L = \{ a^i b^j / i, j \geq 1, i \neq j \}$
[A] $\{ S \rightarrow aS, S \rightarrow aB, B \rightarrow ab, A \rightarrow aaB, B \rightarrow b \}$
[B] $\{ S \rightarrow A, S \rightarrow C, A \rightarrow aA, A \rightarrow aB, B \rightarrow aBb, B \rightarrow ab, C \rightarrow Cb, C \rightarrow Bb \}$
[C] $\{ S \rightarrow A, A \rightarrow aA, A \rightarrow aB, B \rightarrow ab \}$
[D] $\{ S \rightarrow aS, S \rightarrow aB, B \rightarrow ab, A \rightarrow aaB, B \rightarrow b \}$
3. Which of the following statement is wrong
[A] A Turing Machine can not solve halting problem
[B] Set of recursively enumerable languages is closed under union
[C] A Finite State Machine with 3 stacks is more powerful than Finite State Machine with 2 stacks
[D] Context sensitive grammar can be recognized by a linearly bounded memory machine
4. 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] $A \rightarrow \beta A' \mid \alpha A'$
 $A' \rightarrow \alpha A' \mid \epsilon$ $A' \rightarrow \beta A' \mid \epsilon$ $A' \rightarrow \beta A' \mid \alpha$ $A' \rightarrow \epsilon$
5. Which of the following is accepted by deterministic pushdown machine but not accepted by non-deterministic pushdown machine (NDPDAM)
[A] Strings end with a particular alphabet
[B] All strings in which a given symbol is present at least twice.
[C] Even palindrome.
[D] None of these

6. Production Rule: $aAb \rightarrow agb$ belongs to which of the following category?
 [A] Regular Language
 [B] Context free Language
 [C] Context Sensitive Language
 [D] Recursively Enumerable Language
7. Which of the regular expression denotes a language containing all possible strings over the alphabet $\{a,b\}$?
 [A] a^*b^* [B] $(a + b)^*$ [C] $(ab)^*$ [D] $(a+ b^*)$
8. Basis step for extended transition function δ of NFA is
 [A] $\delta(q,\epsilon) = \{q\}$ [B] $\delta(q,a) = \{q\}$ [C] $\delta(q,\epsilon) = \{\epsilon\}$ [D] $\delta(q,a) = \{\epsilon\}$
9. Regarding the power of recognition of language, which of the following statements is false
 [A] The NFA is equivalent to DFA
 [B] NPDA is equivalent to DPDA
 [C] Non-deterministic Turing machines are equivalent to deterministic Push-Down Automata
 [D] Multi-Tape Turing Machine are equivalent to Single-Tape Turing Machine
10. Pumping Lemma is generally used for proving
 [A] A given grammar is regular
 [B] A given grammar is not regular
 [C] Whether two given regular expressions are equivalent or not.
 [D] None of above
11. The basic limitations of Finite state machine is that
 [A] It cannot remember arbitrary large amount of information
 [B] It cannot recognize grammars that are regular
 [C] It sometimes recognize grammars are not regular
 [D] All of these
12. Which of the following is not regular
 [A] String of 0's whose length is a perfect square
 [B] Set of all palindrome made up of 0's and 1's
 [C] Set of all 0's whose length is prime
 [D] String starting with a 1 and ending with 0
13. Any string of terminals that can be generated by the following CFG is

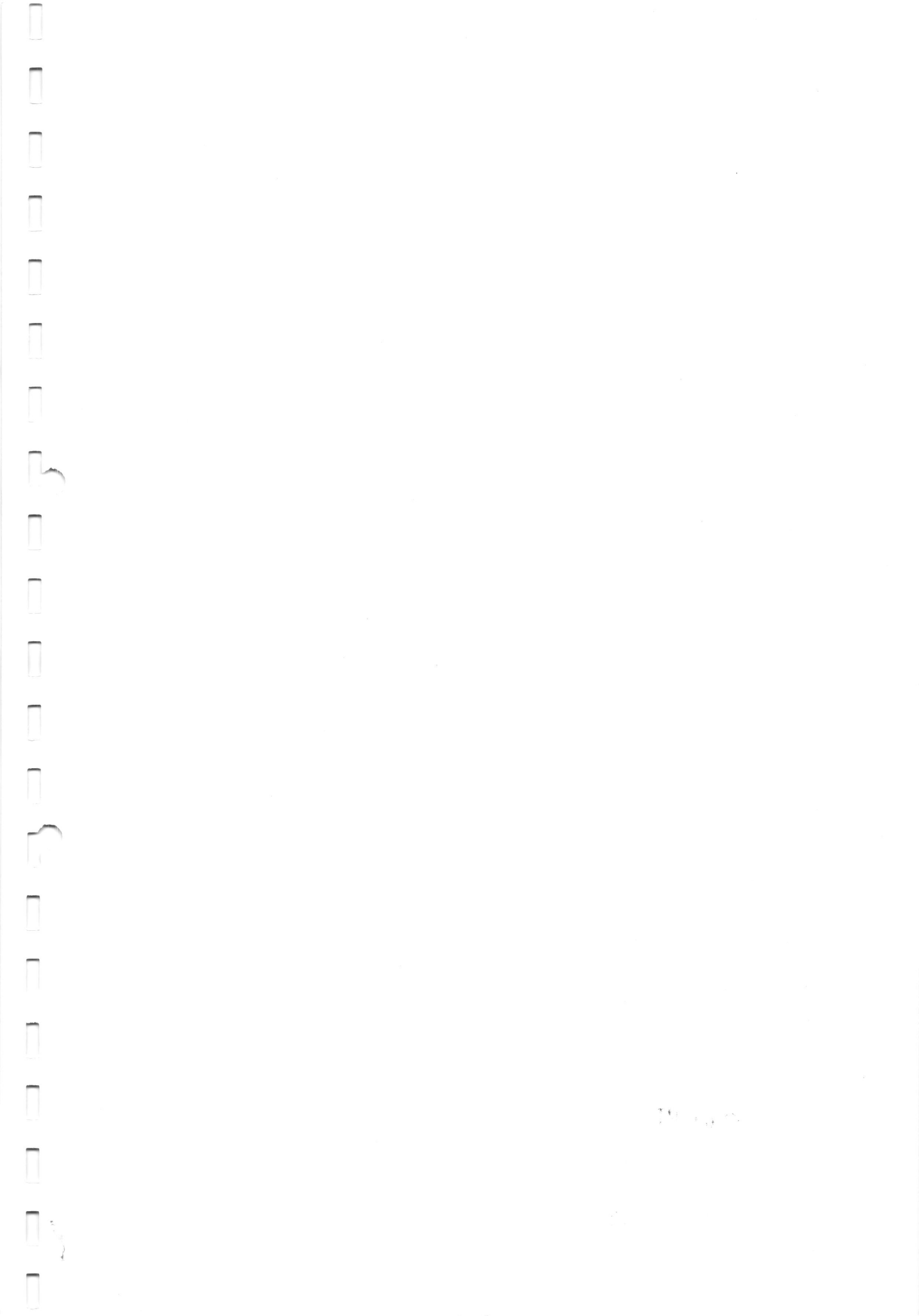
$$S \rightarrow XY$$

$$X \rightarrow ax \mid bx \mid a$$

$$Y \rightarrow Ya \mid Yb \mid a$$
 [A] has atleast one 'b' [B] should end in 'a'
 [C] has no consecutive a's or b's [D] has atleast two a's

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14. Which of the following statement is true?
[A] \emptyset is a regular language expressing expression \emptyset
[B] \emptyset is a regular expression expressing expression ϵ
[C] \emptyset is a regular expression expressing language ϵ
[D] \emptyset is a regular expression expressing language \emptyset
15. Which of the following can be used to simulate any Turing machine?
[A] Finite State Automaton
[B] Universal Turing Machine
[C] Counter machines
[D] Turing Equivalence.
16. Which statement is true?
[A] The PDA must have one accept state and one reject state
[B] The PDA must have one accept state and two reject state
[C] The PDA must have two accept state and two reject state
[D] There is no reject state in the PDA
17. Regular expression for all strings starts with ab and ends with bba is
[A] aba^*b^*bba [B] $ab(ab)^*bba$
[C] $ab(a+b)^*bba$ [D] $ab(aa+bb)^* bba$
18. Consider the following grammar G
G: $S \rightarrow Ax \mid By$
 $A \rightarrow By \mid Cw$
 $B \rightarrow x \mid Bw$
 $C \rightarrow y$
Which of the regular expression describes the same set of strings as the grammar ?
[A] $xw^*y + xw^*yx + ywx$ [B] $xwy + xw^*xy + ywx$
[C] $xw^*y + xwxyx + ywx$ [D] $xwxy + xww^*y + ywx$
19. Language of NFA is given as:
[A] $L(N) = \{w \mid \delta(q_0, w) \cap F \neq F\}$ [B] $L(N) = \{w \mid \delta(q_0, w) \cap F \neq \emptyset\}$
[C] $L(N) = \{w \mid \delta(q_0, w) \cup F \neq F\}$ [D] $L(N) = \{w \mid \delta(q_0, w) \cup F \neq \emptyset\}$
20. Turing machine is more powerful than FSM because
[A] Tape movement is confined to one direction
[B] It has no finite state control
[C] It has the capability to remember arbitrary long sequence of input symbols.
[D] It uses stack as well as finite tape.



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SECTION "B"

[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Define Finite automata with example. How does DFA differ than NFA?
2. Give the DFA for languages of strings over $\{0,1\}$ which
 - a) Accept all strings that do not end with 10.
 - b) Accept the set of all string ending with three consecutive zeros.
3. What is regular language? What are different regular operators? Explain with example.
4. Remove ϵ -productions for each of grammar
$$\begin{aligned} S &\rightarrow AB \\ A &\rightarrow aAA \mid \epsilon \\ B &\rightarrow bBB \mid \epsilon \end{aligned}$$
5. For a regular expression $(a+b)^*baa$, construct ϵ -NFA.
6. Given the CFG
$$\begin{aligned} S &\rightarrow 0AS \mid 0 \\ A &\rightarrow S1A \mid SS \mid 10 \end{aligned}$$
For string 000011000, give the left most and right most derivation and also construct the parse tree.
7. Simplify the following grammar and convert to CNF
$$\begin{aligned} S &\rightarrow ASB \mid \epsilon \\ A &\rightarrow aAS \mid a \\ B &\rightarrow SbS \mid A \mid bb \end{aligned}$$

SECTION "C"

[2Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. State and prove pumping lemma for Context Free Language.
9. Construct a PDA accepting Language:
$$L = \{ww^R \mid w \in (0+1)^* \text{ and } w^R \text{ is reversal of } w\}$$
10. Design a Turing Machine with input alphabet $\{0,1\}$, that recognizes the set of all bit strings that contain an even number of 1's.

