KATHMANDU UNIVERSITY
End Semester Examination
February/March, 2019

Marks Scored:

Level : B. Sc.
Year : III
Course : COMP 316
Semester : I
Exam Roll No. :
Time: 30 mins.
F. M. : 10
Registration No.:
Date : 06 MAR 2019

SECTION "A"
[20Q. × 0.5 = 10 marks]

Choose and tick (√) the most appropriate answer among the given choices.

1. Let $\sum=\{p, q\}$, the value of $\sum^2$ is
   A. {p, q, pq} B. {p, q, qp} C. {p, q, pq, qp} D. {ϵ, p, q, pq, qp}

2. Which of the following statement is true?
   A. $\sum^+=\sum^1 \cup \sum^2 \cup \sum^3 \cup \ldots \cup \sum^n$
   B. $\sum^*=\sum^0 \cup \sum^+$
   C. Both A and B
   D. $\sum^*=\sum^1 \cup \sum^2 \cup \sum^3 \cup \ldots \cup \sum^n$

3. Which of the following statement represents the transition function δ of NFA?
   A. $\delta: Q \times \sum \rightarrow Q$
   B. $\delta: Q \times \sum \rightarrow 2^Q$
   C. $\delta: Q \times \sum \rightarrow Q^2$
   D. $\delta: Q \times \sum \rightarrow \sum$

4. Language of DFA L(D) is defined as
   A. $L(D)=\{w \epsilon \sum^* | \hat{\delta}(q_0,w) \cap F \neq \Phi\}$
   B. $L(D)=\{w \epsilon \sum^+ | \hat{\delta}(q_0,w) \cap F \neq \Phi\}$
   C. $L(D)=\{w \epsilon \sum^* | \hat{\delta}(q_0,w) \in F\}$
   D. $L(D)=\{w \epsilon \sum^+ | \hat{\delta}(q_0,w) \in F\}$

5. What is the equivalence of DFA and NFA?
   A. Both can process and recognize the regular language.
   B. Both can generate the similar strings.
   C. Both are finite state machine with output.
   D. Both are finite state machine that can process Context Free Grammar.

6. Which of the following is RE to represent the set of all strings over $\sum = \{0, 1\}$ containing 00 or 101 as substring?
   A. $(0 + 1)^*(0+101)\ (0 + 1)^*$
   B. $(01)^*(0+101)\ (01)^*$
   C. (0+1)(00+101)(0+1)
   D. $(0 + 1)^*(0.101)\ (0 + 1)^*$

7. Which of the following statement is true, If P, Q and R are any regular language?
   A. $P \cup Q = Q \cup R$
   B. $P(Q \cup R) = PQ \cup PR$
   C. $P \cup Q \cup R = Q \cup R$
   D. $P(Q \cup R) = PQR$

8. Sentential form of the CFG is
   A. Any string from $(V \cup T)^*$ that can be derived from any variable.
   B. Any string from $(V \cup T)^+$ that can be derived from any variable.
   C. Any string from $(V \cup T)^*$ that can be derived from start variable.
   D. Any string from $(V \cup T)^+$ that can be derived from start variable.

9. If A,Bϵ V and aϵT then A production P is unit production if it is of the form
   A. A→B B. A→a C. A→aB D. A→AB

10. The variable AϵV is generating symbol if
A. $A \overset{*}{\Rightarrow} w$ B. $A \overset{*}{\Rightarrow} V^*$ C. $A \overset{*}{\Rightarrow} T^*V^*$ D. $A \overset{*}{\Rightarrow} w^*V^*$

11. Let X, Y,ZϵV and pϵT then which of the following production is allowed in CNF?
A. X→pYZ
B. X→YZ or X→p
C. A→YZ
D. X→YZ or X→pYZ

12. Let the production A→Aα/β with β doesn't start with A, the equivalent grammar without left recursion can be written as
A. A→ $\beta A'/\beta$, $A' \rightarrow \alpha A'/\alpha$
B. A→ $A'\beta/\alpha$, $A' \rightarrow \alpha A'/\beta$
C. A→ $A'\beta$, $A' \rightarrow \alpha A'/\epsilon$
D. A→ $\beta A'/$, $A' \rightarrow \alpha A'/\beta$

13. Which of the following condition must be satisfied before converting the grammar into GNF?
A. The grammar must be simplified.
B. The grammar must be in CNF.
C. The grammar must be without left recursion.
D. Both B and C

14. The transition function of PDA P={Q, $\sum$, τ, δ, q_0, z_0, F} is defined as
A. δ: Q× $\sum$ →Q× τ^*
B. δ: Q× $\{\sum \cup \epsilon\} \times \tau$ →Q× τ^*
C. δ: Q× $\{\sum \cup \epsilon\}$ →Q× τ^*
D. δ: Q× $\sum \times \tau$ →Q× τ^*

15. The transition function of Non-deterministic PDA is
A. δ: Q× $\{\sum \cup \epsilon\} \times \tau \rightarrow (Q \times \tau^*)^*$
B. δ: Q× $\sum \times \tau$ →any subset of $(Q \times \tau^*)^*$
C. δ: Q× $\{\sum \cup \epsilon\} \times \tau$ →Q× τ^*
D. δ: Q× $\{\sum \cup \epsilon\} \times \tau$ →any subset of $(Q \times \tau^*)^*$

16. If q is any state of PDA, w is the remaining string to read and τ is the stack content then the ID of PDA is represented as
A. (q, w, τ) B. (q, τ, w) C. (w, q, τ) D. (τ, w, q)

17. Which of the following statement is true for the acceptance of strings by PDA?
A. acceptance by final state.
B. acceptance by empty stack.
C. both A and B.
D. acceptance by stopping criteria.

18. Which of the following can accept even palindrome over $\sum$={a, b}?
A. Push Down Automata
B. Turing Machine
C. NDFA
D. DPDA

19. An ID of Turing Machine consists of
A. present state and input to be processed
B. present input only
C. present state and entire input to be processed
D. input to be processed

20. Turing machine (TM) is more powerful than FMS (Finite State Machine) because
A. tape movement is confined to one direction
B. it has the capability to remember arbitrarily long sequences of input symbols
C. it has no finite state
D. it has infinite state

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SECTION "B"

[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Construct a DFA with transition diagram and transition table that accepts the language L= {w| w is string of the form x01y where x and y are any strings of 0's and 1's}. [4]

2. Convert the following NFA into equivalent DFA. [4]

	0	1
$\rightarrow q_0$	$\{q_0\}$	$\{q_0, q_1\}$
q_1	$\{q_2\}$	$\{q_2\}$
$*q_2$	Φ	Φ

3. State and prove Arden's Theorem. [4]

4. Construct the finite automata from the following regular grammar. [4]

   S→abA
   S→baB
   S→aA/bb

5. Convert the following grammar into GNF. [4]

   S→XY
   X→xX|yY|y
   Y→y

6. Design a deterministic PDA which accepts a language L=$\{0^n 1^{2n}: n \geq 0\}$ [4]

7. Construct a Turing Machine M to accept the set of all strings over $\sum$={a, b} ending with aba. [4]

SECTION "C"

[2Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Prove that a language L is accepted by some DFA if and only if L is accepted by NFA. [8]

9. Define CNF with suitable example. Simplify the following grammar. [2+6]

   S→ABC
   A→BC|a
   B→bAC|ε
   C→cAB|ε

10. Write short notes with example. [4+4]
    a. Ambiguous Grammar b. Instantaneous Description of PDA