KATHMANDU UNIVERSITY
End Semester Examination [C]
June/July 2024

Level : B.Sc.
Year : III
Time : 2 hrs. 30 mins.

02 JUL 2024

Course : COMP 316
Semester : I
F.M. : 40

SECTION "B"
[6 Q. × 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 that ends with bb over ∑={0,1}} [4]

2. Prove that language L={$a^n b^n$|n≥0 } is not a regular language. [4]

3. What is the equivalence between regular expression and finite automata? Explain with relevant theorem. [1+3=4]

4. How string can be derived from the Context Free Grammar? Explain with example. [4]

5. Convert the following NFA into DFA. [4]

	0	1
->p	{p, q}	{p}
q	Φ	{r}
*r	{p, r}	Φ

6. How do you remove the immediate left recursion? Illustrate with example. [4]

7. Explain Instantaneous Description (ID) of Push Down Automata with suitable example.[4]

SECTION "C"
[2 Q. × 8 = 16 Marks]

Attempt *ANY TWO* questions.

8. How a ∈-NFA can be converted into DFA? Explain with suitable example. [8]

9. Define CNF with suitable example. Convert the following grammar into CNF. [2+6=8]

   S → AACD
   A → aAb | ε
   C → aC | a
   D → aDa | bDb | ε

10. Write short notes with example. [4+4=8]
    a. Multi-tape Turing Machine
    b. Equivalence of PDA and CFG

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Marks Scored:

Level : B.Sc.
Year : III
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Exam Roll No. :
Time: 30 mins.
F. M. : 10

Registration No.:
Date : 02 JUL 2024

SECTION "A"
[20Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate answer:

1. The transition function δ of NFA is
   a. $\delta: Q \times \Sigma \rightarrow Q$ b. $\delta: Q \times \Sigma \rightarrow 2^Q$ c. $\delta: Q \times \Sigma \rightarrow Q^2$ d. B. $\delta: Q \times \Sigma \rightarrow \Sigma$

2. Basic step for extended transition function δ of DFA is
   a. $\delta(q,a) = \{q\}$ b. $\delta(q,\epsilon) = \{\epsilon\}$ c. $\delta(q,\epsilon) = q$ d. $\delta(q,a) = \{\epsilon\}$

3. Language of an DFA L(D) is defined as
   a. $L(D) = \{w \epsilon \Sigma^* | \hat{\delta}(q_0,w) \cap F \neq \Phi\}$ b. $L(D) = \{w \epsilon \Sigma^+ | \hat{\delta}(q_0,w) \cap F \neq \Phi\}$
   c. $L(D) = \{w \epsilon \Sigma^* | \hat{\delta}(q_0,w) \in F\}$ d. $L(D) = \{w \epsilon \Sigma^+ | \hat{\delta}(q_0,w) \in F\}$

4. According to Arden's rule what is the unique solution for r=q+rp if p and q be two R.E over ∑ and p≠∈?
   a. $r = qp^+$ b. r = qp d. $r = qp^*$ d. $r = qp + qp^*$

5. Which of the following is RE to represent the set of all strings over $\Sigma = \{0,1\}$ with substring 01?
   a. $(0+1)^* 01 (0+1)^*$ b. $(01)^*$
   c. (0+1)(0+1)01 d. $(0+1)^*$

6. Which of the following algebraic rule is true for Regular Expression?
   a. q+(r.s) = (q.r).s b. p.(q+ r) = pq+pr
   c. $\epsilon . r = \epsilon$ d. $r + r = r^*$

7. Which of the following statement is true for pumping lemma?
   a. Pumping Lemma is used to convert regular grammar into finite automata.
   b. Pumping Lemma is used for proving the language not to be regular.
   c. Pumping Lemma is used for proving the language to be regular.
   d. Pumping Lemma is used to convert regular language into context free grammar.

8. The variable AϵV is generating symbol if
   a. $A \overset{*}{\Rightarrow} w$ b. $A \overset{*}{\Rightarrow} V^*$ c. $A \overset{*}{\Rightarrow} T^* V^*$ d. $A \overset{*}{\Rightarrow} w^* V^*$

9. Which of the following grammar is left linear?
   a. S→S10/0 b. S→0A, A→10A/∈
   c. S→0S/1S/0 d. Both B and C

10. Which of the following grammar is without left recursion ?
a. $A \rightarrow \beta A'/\alpha,\ A' \rightarrow \alpha A'/\beta$ b. $A \rightarrow A'\beta/\alpha,\ A' \rightarrow \alpha A'/\beta$
c. $A \rightarrow A'\beta,\ A' \rightarrow \alpha A'/\epsilon$ d. $A \rightarrow \beta A'/\beta,\ A' \rightarrow \alpha A'/\alpha$

11. If A,BϵV 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

12. Which of the following condition must be satisfied before converting the grammar into GNF?
a. The grammar must be simplified and productions are of the form $A \rightarrow BC$ or $A \rightarrow a$.
b. The grammar must be in CNF.
c. The grammar must be without left recursion.
d. Both B and C

13. 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.

14. The transition function of deterministic PDA P={Q, $\sum$, τ, δ, q_0, z_0, F} is defined as
a. δ: Q× $\sum$ →Q× τ^* b. δ: Q× {$\sum \cup \epsilon$} →Q× τ^*
c. δ: Q× {$\sum \cup \epsilon$} × τ →Q× τ^* d. δ: Q× $\sum$ × τ →Q× τ^*

15. The variable AϵV is generating symbol if
a. $A \overset{*}{\Rightarrow} w$ b. $A \overset{*}{\Rightarrow} V^*$ c. $A \overset{*}{\Rightarrow} T^*V^*$ d. $A \overset{*}{\Rightarrow} w^*V^*$

16. Which of the following represents the configuration of PDA? Here q represents start state, w represents remaining input string and ϒ represents stack contents.
a. (q,w) b. (q,w,ϒ) c. (q, ϒ) d. (w,q)

17. The language of PDA P that accepts strings by empty stack is defined as
a. L(P) = {w|(q_0, w, z_0) |-(q_f, ϵ, γ); $q_f \epsilon F$ and $\gamma \epsilon \tau^*$}
b. L(P) = {w|(q_0, w, z_0) |-(q_f, τ, γ); $q_f \epsilon F$ and $\gamma \epsilon \tau^*$}
c. L(P) = {w|(q_0, w, z_0) |-$(q, \epsilon, , \epsilon)$ }
d. L(P) = {w|(q_0, w, z_0) |-$(q_f, , \epsilon, , \epsilon)$ }

18. An ID of single tape Turing Machine has
a. input to be processed
b. present state and head movement
c. present state and entire input to be processed
d. present input only

19. Turing machine (TM) doesn't consists of which of the following component?
a. tape head b. input tape c. finite control d. stack

20. Which of the following are the models equivalent to turing machine?
a. Multi-Tape Turing Machine b. Universal Turing Machine
c. Both A and B. d. Computing Machine