CS & IT ENGINEERING

Theory of Computation

Grammar

Dpp-01 **Discussion Notes**

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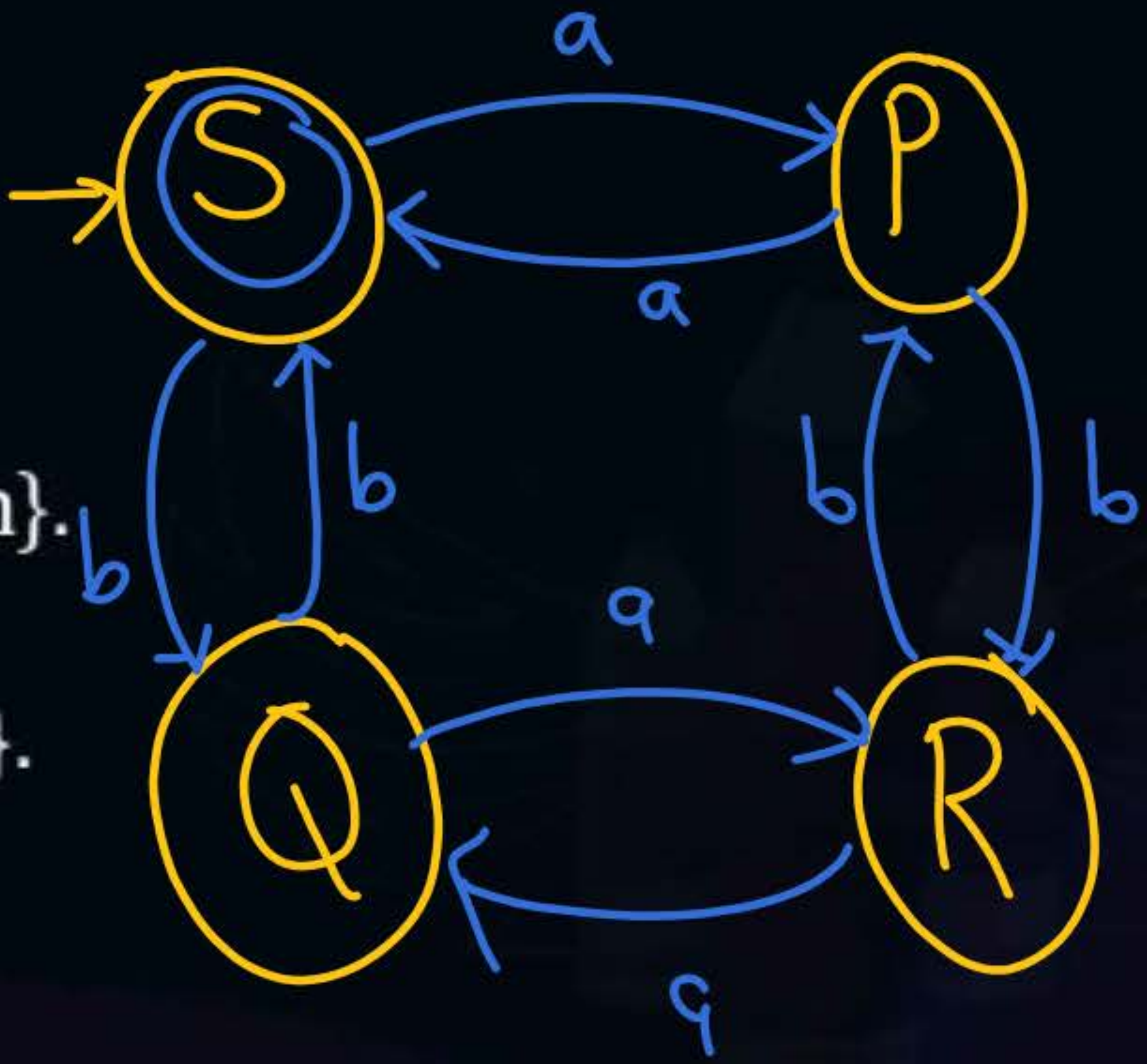
[MCQ] 2-Mark

#Q. Consider alphabet $\Sigma = \{a, b\}$, the empty string $\in$ and the set of strings S, P, Q and R generated by the corresponding non-terminals of a regular grammar. S,P, Q and R related as follows (S is a start symbol):

$$\boxed{\begin{aligned} S &\to aP \mid bQ \mid \in \\ P &\to bR \mid aS \\ Q &\to aR \mid bS \\ R &\to aQ \mid bP \end{aligned}}$$



A. $L = \{w: n_a(w) \text{ and } n_b(w) \text{ both are even}\}$.

B. $L = \{w: n_a(w) \text{ and } n_b(w) \text{ both are odd}\}$.

C. $L = \{w: n_a(w) \text{ or } n_b(w) \text{ are even}\}$.

D. None of these.

[MCQ] 2-Mark

#Q. Consider alphabet $\Sigma = \{a, b\}$, the empty string $\in$ and the set of strings S, P, Q and R generated by the corresponding non-terminals of a regular grammar. S,P, Q and R related as follows (S is a start symbol):

$S \rightarrow aP \mid bQ \mid \in$

$P \rightarrow bR \mid aS$

$Q \rightarrow aR \mid bS$

$R \rightarrow aQ \mid bP$

A. $L = \{w: n_a(w)$ and $n_b(w)$ both are even$\}$.

B. $L = \{w: n_a(w)$ and $n_b(w)$ both are odd$\}$.

C. $L = \{w: n_a(w)$ or $n_b(w)$ are even$\}$.

D. None of these.

[MSQ] 2-Mark

$a(a+b)^+a + b(a+b)^+b$

#Q. Consider the following language L on alphabet $\Sigma = \{a, b\}$

$L = \{wxw^R \mid w, x \in \{a, b\}^+\}$ → regular language

The correct regular grammar of above language is/are possible?

$\underline{a(a+b)^+a} + \underline{b(a+b)^+b}$

A
$S \to aAa \mid bAb$
$A \to aA \mid bA \mid a \mid b$ $\quad (a+b)^+$
$B \to aA \mid bA \mid a \mid b$ $\quad (a+b)^+$

B
$S \to aAa \mid bAb \mid \in$
$A \to ab$

$\underline{a(a+b)^*a} + \underline{b(a+b)^*b}$

C
$S \to aA \mid bB$
$A \to aA \mid bA \mid a$ → $(a+b)^*a$
$B \to bB \mid aB \mid b$ — $\underline{(a+b)^*b}$

D
$S \to Aa \mid Bb$
$A \to Aa \mid Ab \mid a$ $\quad a(a+b)^*$
$B \to Bb \mid Ba \mid b$ $\quad b(a+b)^*$

[MCQ] 2-Mark

#Q. Consider the following grammar G:

G:

$S \rightarrow \underline{A}\ B\ C$ $\quad S \rightarrow a^+ bc\, c^*$

$A \rightarrow aA \mid a \rightarrow a^+$ $\quad \rightarrow \underline{a^+ b\, c^+}$

$B \rightarrow bc$

$C \rightarrow \underline{c}C \mid \in \rightarrow c^*$

The language generated by above grammar is?

A ✗ $L = \{a^* \, bc \, c^*\}$

B ✓ $L = \{a^+ \, b \, c^+\}$

C ✗ $L = \{a^* \, b \, c^*\}$

D None of these

[MSQ] 2-Mark

#Q. Consider the following two language L_1 and L_2.

$L_1 = \{www \mid w \in \{a\}^*\} = \{\epsilon, a^3, a^6, a^9 \ldots\} = (aaa)^*$

$L_2 = \{\{a^{n^n}\}^* \mid n \geq 1\} = (a^1)^* \cup \ldots = a^*$

Which of the following is correct?

A. L_1 is regular.

B. L_2 is regular.

C. Both L_1 and L_2 are regular.

D. None of these.

[MSQ] 2-Mark

#Q. Which of the following language is non-regular?

regular $(a+b)^* \cup \dots = (a+b)^*$

A) $L = \{\cancel{w}x\cancel{w}^R \mid x, w \in \{a, b\}^*\} = (a+b)^*$

regular $(a+b)^* \cup \dots$

B) $L = \{\cancel{w}^{\epsilon}x\cancel{w}^{\epsilon} \mid w, x \in \{a, b\}^*\} = (a+b)^*$

C) $L = \{\cancel{w}x\cancel{w}x \mid w, x \in \{a, b\}^*\} = (a+b)^*$

D) None of these

[MSQ]

$S = aa^n b^n b$

#Q. Consider the following grammar G_1 and G_2:

G_1: $S \to aAb$

Non regular

$A \to aB \mid \epsilon$

$B \to Ab$

$A \to aB = A \to aAb \mid \epsilon\}$ $a^n b^n$

G_2: $S \to aABb$

$A \to aA \mid \epsilon \to a^*$

$B \to bB \mid \epsilon \to b^*$

$S \to a a^* b^* b$

$S \to a^+ b^+$

G_2

Which of the following grammar generates a regular language?

A) G_1 only

B) G_2 only

C) Both G_1 and G_2

D) None of these

[NAT] 2-Mark

#Q. Consider the following three languages:

(1) $L = \{a^{n^n} \mid n \geq 1\}$ $= \{a^{1}, a^{2^2}, a^{3^3}, a^{4^4} \ldots\} =$ Non Regular

(2) $L = \{a^{m^n} \mid m = n^2, n \geq 1\}$ $= \{a^{(n^2)^n} \ldots\} =$ Non Regular

(3) $L = \{a^{m^n} \mid n \geq 1, m > n\}$ $=$ regular $= a\,a^{+}$

Total number of regular languages is/are_____. 1

$\{a^{m^n}\}$ $\{a^{m^1}\}$ $\{a^2, a^3, a^4, \ldots\} \cup \{a^{m^2}\}$

[MCQ] 2-Mark

#Q. Which of the following language is non-regular?

$\{a^{2m} b^{2n} \mid n, m \geq 1\}$

A. $L = \{a^{2m} b^n b^n \mid m, n \geq 1\}$ → regular

regular

$a^m \cdot b^n (a+b)^*$

B. $L = \{a^m b^n X \mid m, n \geq 1, X \in \{a,b\}^*\}$

C. $L = \left\{\{a^{n^2}\}^* \mid n \geq 0\right\}$ — regular

$(a^1)^* = a^* \cup \text{–} = a^*$

D. None of these

[MCQ] 2-Mark

$(a^*)^* = \underline{a^*}$

#Q. Consider the following statements:

S_1: Kleene Closure (*) of infinite set is always finite. $\rightarrow$ $\underline{\text{false}}$

false S_2: Kleene Closure (*) of finite set is always infinite. $\underline{\{\epsilon\}^*} = \{\epsilon\}$

Which of the following is correct?

A. S_1 only.

B. S_2 only.

C. Both S_1 and S_2 are correct.

D. None of these

[NAT] 2-Mark

#Q. Consider the following statements:

[I] If L is regular, then $\overline{L}$ is regular. → true

[II] If $\overline{L}$ is regular, then L is regular. → true

[III] Union of L and its complement is Σ^*. → true

Number of correct statement is/are 3 .

$$\cancel{L} + (\Sigma^* - \cancel{L}) = \Sigma^*$$

[MSQ] 2-Mark

#Q. Consider a regular language L, which of the following statements are true regarding L.

(A, B, C)

A. Prefix(L) = $\{w \mid ww_1 \in L, w_1 \in \Sigma^*\}$ is regular.

B. Suffix(L) = $\{w \mid w_1w \in L, w_1 \in \Sigma^*\}$ is regular.

C. Quotient (L) = [redacted] is regular.

D. L is closed under infinite intersection.

[MCQ] 2-Mark

#Q. Consider a regular language L over the alphabet $\Sigma = \{a, b\}$. L is defined as $L = (a + b^*)\ (bab^*)$.

If homomorphism h is defined over $T = \{c, d, e\}$ and

$h(a) = cd$

$h(b) = cddec$

Then the regular language h(L) is given as

$h[(a + b^*)\ (bab^*)]$

$[h(a) + h(b)^*]\ h(b)\ h(a)\ h(b)^*$

$[cd + (cddec)^*]\ (cddec)(cd)(cddec)^*$

A. (cd + cddec) (cddec cd cddec)

B. (cddec) (cd + cddec*)

C. (cd + (cddec)*) ((cddec) (cd) (cddec)*)

D. None of these

THANK - YOU