CS & IT ENGINEERING

Theory of Computation

Regular Language & Grammars

Dpp-01 Discussion Notes

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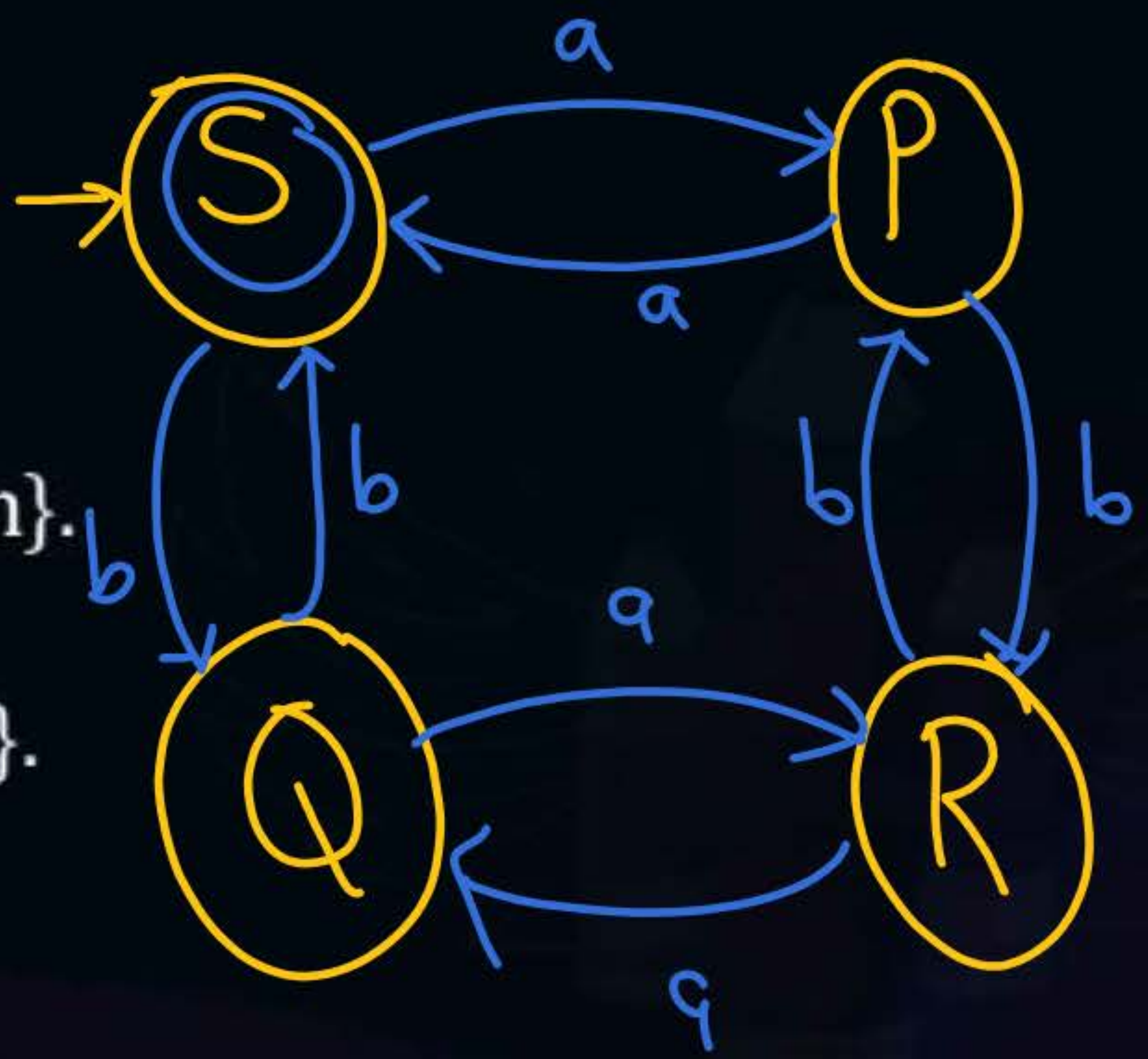
[MCQ] 2-Mark

#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):

$$\boxed{\begin{array}{l} S \rightarrow aP \mid bQ \mid \in \\ P \rightarrow bR \mid aS \\ Q \rightarrow aR \mid bS \\ R \rightarrow aQ \mid bP \end{array}}$$



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

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.

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

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

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

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

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

[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.

$L_1 = \{\underset{a^2}{w}\underset{a^2}{w}\underset{a^2}{w} \mid w \in \{a\}^*\} = \{\epsilon, a^3, a^6, a^9 \ldots\} = (aaa)^*$

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

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?

$(a+b)^* \cup \cdots = (a+b)^*$

regular

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

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

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) × $L = \{a^{n^n} \mid n \geq 1\} = \{a^{1^1}, a^{2^2}, a^{3^3}, a^{4^4} \ldots\}$ = 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 $= aa^+$

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

$(a^1)^* = a^* \cup - = a^*$

D. None of these

[MCQ]

2-Mark

$(a^*)^* = a^*$

#Q. Consider the following statements:

S_1: Kleene Closure (*) of infinite set is always finite. → false

false S_2: Kleene Closure (*) of finite set is always infinite.

$\{\epsilon\}^* = \{\epsilon\}$

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