Q.1) Max Marks: 1

Given L1=L(a*baa*) and L2=L(ab*). The regular expression corresponding to language L3 = L1/L2 (right quotient) is given by

A a*b

B a*baa*

C a*ba* — Correct Option

Solution: (C)

Answer:C

Explanation:

L1={a*baa*}={ba,aba,abaa,abaaa*,aa*baaa*,a*ba*a.....}

L2={ab*}={a,ab,abb*...}

L1/L2=a*ba* ={b,ab,aba,abaa,a*baa....} so ans is C

L1/L2={x: xy belongs to L1 for some y belongs to L2}

D None of the above

Q.2) Max Marks: 1

Let R=(1+0)*1 ,S=11*01 and T=1*01 be Three regular expressions. Then which one of the following is/are true

A L(S) $\subseteq$ L(T) and L(T) $\subseteq$ L(R) — Correct Option

Solution: (A)

Answer: A

Solution:

L(R) = {1, 01, 11, 001, 011, 101,110,........}

L(S) = {101, 1101,11101,111101,..............}

L(T) = {01,101,1101,11101,.......................}

L(S) $\subseteq$ L(T) and L(T) $\subseteq$ L(R)

B L(T) $\subseteq$ L(S) and L(T) $\subseteq$ L(R)

C L(S) $\subseteq$ L(R) and L(R) $\subseteq$ L(T)

D None of these

Q.3) Max Marks: 1

Consider the Regular expression R=(a+b)*(aa+bb)(a+b)*. Which of the following Regular expressions describes the language represented by R

A R1 = (a(ba)*(a+bb)+b(ab)*(b+aa))(a+b)$^+$

B R2 = (a(ba)*(a+bb)+b(ab)*(b+aa))(a+b)* — Correct Option

Solution: (B)

Answer:B

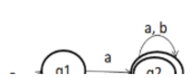
Solution:

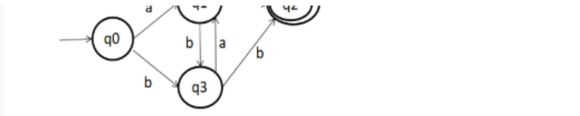
Given regular expression R=(a+b)*(aa+bb)(a+b)*

Generates all the strings that contains the substring aa or bb

R2 = (a(ba)*(a+bb)+b(ab)*(b+aa))(a+b)*

The Finite Automata for the given RE is





C R3 = (a(ba)*+b(ab)*)+(a+b)*

D R4 = (a(ba)*+b(ab)*)(a+b)*

Q.4)

Max Marks: 1

Regular expression for the language L = { w ∈ {0, 1}* | w has no pair of consecutive zeros} is

A (1 + 010)*

B (01 + 10)*

C (1 + 010)* (0 + ε)

D (1 + 01)* (0 + ε)

Correct Option

Solution: (D)

Answer: D

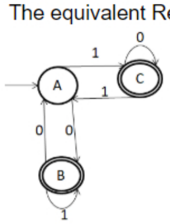
Explanation:

Strings 010010 can be generated with option a) by using 010 twice. String 1001 can be generated with option b). string 0100 can be generated with option c). So except d) option all can generate strings with 00 as a substring.

Q.5)

Max Marks: 1

The equivalent Regular Expression for the given DFA is



A (01*0+10*1)(01*+10*)

B (01*0+10*1)*(01*+10*)

Correct Option

Solution: (B)

Answer:B

Explanation:

Apply Arden's Lemma

A= ε +C1+B0------->(1)

B=A0 +B1 ⇒ B = A01* (R= Q+RP ⇒ R=QP*)------>(2)

C=A1+C0 ⇒ C = A10* --------->(3)

Substitute (2) and (3) in equation(1)

A = ε + A10*1+A01*0 = ε + A(10*1+01*0)= (10*1+01*0)*

B = A01* = (10*1+01*0)*01*

C= A10* = (10*1+01*0)*10*

RE is B+C as Both B and C are final states

(10*1+01*0)*01* + (10*1+01*0)*10*

(10*1+01*0)* (01* +10*)

C (01*0)*01*+(10*1)*10*

D None of these

Q.6)

Max Marks: 1

Consider the following languages over the alphabet Σ = {a,b}

$L_1 = \{a^m b^n \mid m,n \geq 0\}$

$L_2 = \{a^p \mid p \text{ is a prime}\}$

Which of the following is True

A L_1-L_2 is a Regular language

B $L_1 \cup L_2$ is a Regular language Correct Option

Solution: (B)

Answer:B

Explanation:

We know that L_1 is regular and L_2 is not regular. It is also clear $L_2 \subset L_1$.

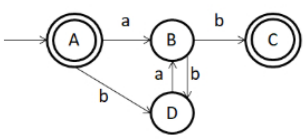
$L_1 - L_2 = L_1 \cap L_2^c = \{a^p | \text{ p is not a prime}\}$. Which is not regular. Because complement of this language is $(L_1 \cap L_2^c)^c = \{a^p | \text{ p is prime }\}$ which is a standard non-regular language. $L1 \cup L2 = L1$, hence $L1 \cup L2$ is also regular.

C $L_1 \cap L_2$ is a Regular language

D None of these

Q.7) Max Marks: 1

Consider the following FSM M



The Regular expression that generates the language accepted by the given FA

A (a+ba)(ba)*b

B ε+(a+ba)*bab

C ε+(a+ba)(ba)*b Correct Option

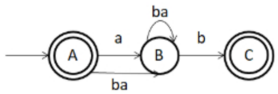
Solution: (C)

Answer:C

Explanation:

Initial state is the final state. So ε is part of the RE

If we remove the state D, Loop forming on B and we are reaching from A to B via D.



RE is ε+(a+ba)(ba)*b

D None of these

Q.8) Max Marks: 1

Regular expression for the language $L = \{ w \in \{0, 1\}^* \mid w$ has no pair of consecutive zeros$\}$ is

A (1 + 010)*

B (01 + 10)*

C (1 + 010)* (0 + ε)

D (1 + 01)* (0 + ε) Correct Option

Solution: (D)

Answer:D

Explanation:

Strings 010010 can be generated with option a) by using 010 twice.

String 1001 can be generated with option b).

String 0100 can be generated with option c).

So except d) option all can generate strings with 00 as a substring.

Q.9)

Max Marks: 1

The language generated by the given regular expression over the alphabet Σ={a,b}

$a\Sigma^*a\Sigma^*a \cup b\Sigma^*a\Sigma^*a\Sigma^*a\Sigma^*b$

A. Generates all strings of a's and b's such that the first and last symbol are the same.

B. Generates all strings of a's and b's such that every string contains exactly 3 a's.

C. Generates all strings of a's and b's such that the first and last symbol are the same and every string contains at least 3 a's — Correct Option

Solution: (C)

Answer: C

Explanation:

Given RE is $a\Sigma^*a\Sigma^*a \cup b\Sigma^*a\Sigma^*a\Sigma^*a\Sigma^*b$

⇒ a(a+b)*a(a+b)*a + b(a+b)*a(a+b)*a(a+b)*a(a+b)*b

Possible strings are ={aaa,baaab,ababa,aaaa,............}

Every string starts and ends with the same symbol and contains at least 3 a's

D. Generates all strings of a's and b's such that the first and last symbol are the same and every string contains at most 3 a's

Q.10)

Max Marks: 1

Which of the regular expressions corresponds to this grammar ?

S → AB / AS, A → a / aA, B → b

A. aa^*b^+

B. aa^*b — Correct Option

Solution: (B)

Answer:B

Explanation:

S→ AB

→ ab

S→ AB

→ aAb

→aab

The strings that are generated by the Grammar is

={ab,aab,aaab,.........} u {aab,aaab,......} = {ab,aab,aaab,........} = a^+b = aa^*b

C. $(ab)^*$

D. $a(ab)^*$

Q.11)

Max Marks: 2

Which of the following languages is/are regular

A= $\{a^mb^n \mid m=n \;\&\; m,n \geq 0\}$

B= $\{a^mb^n \mid m+n = even \;\&\; m,n \geq 0\}$

C= $\{a^mb^n \mid m+n = odd \;\&\; m,n \geq 0\}$

D= $\{a^mb^n \mid m \neq n \;\&\; m,n \geq 0\}$

A. A and B only

B. B and C only — Correct Option

Solution: (B)

Answer:B

Explanation:

A= $\{a^mb^n \mid m=n \;\&\; m,n \geq 0\}$ Non-Regular. Need memory element to check the equality between #a's and #b's

B= $\{a^mb^n \mid m+n = even \;\&\; m,n \geq 0\}$ Regular m+n is even {even+ even=even and odd+odd =even}

RE for the language is (aa)*(bb)* + a(aa)*(bb)*b

C= $\{a^m b^n \mid m+n = \text{odd} \ \& \ m,n \geq 0\}$ Regular

m+n is odd {even+ odd=odd and odd+even =even}

RE for the language is (aa)*(bb)*b + a(aa)*(bb)*

D= $\{a^m b^n \mid m \neq n \ \& \ m,n \geq 0\}$ Non Regular. Need memory element to check the non-equality between #a's and #b's

C — **C and D only**

D — **A and D only**

Q.12)

Max Marks: 2

Let L1 and L2 be 2 languages which are not regular. Which of these is true?

I. The union of L1 and L2 is not regular.

II. The intersection of L1 and L2 is not regular.

A — **Both I and II are true**

B — **I is true, II is false**

C — **I is false, II is true**

D — **Both I and II are false** — Correct Option

Solution: (D)

Answer:D

Explanation:

Let $L1=a^n b^n$ and $L2=\{a^x b^y \mid x!=y\}$

1. L1 U L2 : L=a*b* which is clearly a Regular Language. Hence I is False.

2. L1 ∩ L2: L={} which is Regular Language. Hence II is False.

So, (D) Both I and II are False.

Q.13)

Max Marks: 2

Consider the following operations over the regular languages L_1 and L_2

I. $nor(L_1, L_2) = \{w: w \notin L_1 \text{ and } w \notin L_2\}$

II. $cor(L_1,L_2) = \{w: w \in L_1^c \text{ or } w \in L_2^c\}$

Which of the following is True

A — **I is Regular**

B — **II is Regular**

C — **Both I and II are Regular** — Correct Option

Solution: (C)

Answer: C

nor $(L_1, L_2) = (L_1 \cup L_2)^c = L_1^c$ intersection L_2^c = Regular, As the regular languages are closed under complement and intersection operations.

$cor(L_1,L_2) = L_1^c$ union L_2^c = Regular, As the regular languages are closed under complement and union operations.

D — **Neither I nor II are Regular**

Q.14)

Max Marks: 2

Let Σ={0,1}, L=Σ* and $R=\{0^m 1^n 0^p \mid m+n=p, m,n,p>0\}$ then the languages L∪R and R are respectively

A — **regular, regular**

B — **not regular, regular**

C — **regular, not regular** — Correct Option

Solution: (C)

Answer (C):
L∪R is nothing but L, R is a subset of L and hence regular.
R is deterministic context-free but not regular as we require a stack to keep the count of 0's and 1's to match with 0's.

D not regular, not regular

Q.15)

Max Marks: 2

Let R1 and R2 be the regular languages over the alphabet Σ , then which of the following is False

A Σ^*-(R1 $\cap$ R2) is Regular

B (R1 $\cup$ R2^c)* is Regular

C (R1 $\cup$ R2)* = (R1 $\cap$ R2)*

Correct Option

Solution: (C)

Solution:

Let R1 = a* and R2 = b* then

(R1 $\cup$ R2)= {ε,a,aa,aaa,..........} u {ε,b,bb,bbb,.............}

= {ε, a,b,aa,bb,aaa,bbb,...................}

(R1u R2)* ={ε, a,b,aa,ab,ba,bb,aaa,bbb,...................}

(R1 $\cap$ R2) = {ε}

(R1 $\cap$ R2)* = {ε}

Option C is False

Option A: Σ^*-(R1 $\cap$ R2) is Regular

Regular languages are closed under intersection and complement Operations.

(R1 $\cap$ R2) = R is Regular

Then Σ^*-(R) is the Complement of R which also Regular language. True

Option B: (R1 $\cup$ R2^c)* is Regular

R2 is Regular and R= complement of R2 is also regular.

R1u R is Regular and Regular languages are closed under Kleene closure operation. True

Option D: (R1^c $\cup$ R2)* is Regular True

D (R1^c $\cup$ R2)* is Regular

close