Kunal Jha
Course: GATE
Computer Science Engineering(CS)

THEORY OF COMPUTATION-1: (GATE - 2021) - REPORTS

OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(17) | CORRECT(6) | INCORRECT(11) | SKIPPED(0)

Q. 1 FAQ | Solution Video | Have any Doubt ?

The equivalent production rules corresponding to the production rules
$S \Rightarrow Sa_1 \mid Sa_2 \mid b_1 \mid b_2$ is?

A $S \Rightarrow b_1 \mid b_2, A \Rightarrow a_1A \mid a_2A \mid \in$

B $S \Rightarrow b_1 \mid b_2 \mid b_1A \mid b_2A, A \Rightarrow a_1A \mid a_2A \mid \in$ — Correct Option

Solution :
(b)
Usually two production rules are equivalent if they produces the same language. But here, in the given production rules if we observe the options we can see we are just removing the Left-Recursion. Hence equivalent production will be

$$S \Rightarrow b_1 \mid b_2 \mid b_1A \mid b_2A$$
$$A \Rightarrow a_1A \mid a_2A \mid \in$$

So, option (b) is correct.

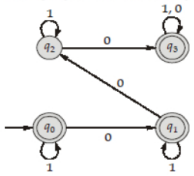
C $S \Rightarrow b_1 \mid b_2 \mid b_1A \mid b_2A, A \Rightarrow a_1A \mid a_2A$

D None of the above — Your answer is **Wrong**

QUESTION ANALYTICS +

Q. 2 FAQ | Solution Video | Have any Doubt ?

What language does the following DFA compute?



A $\{w \mid w$ is a string that contains exactly three 0's$\}$

B $\{w \mid w$ is a string that contains one or three 0's$\}$ — Your answer is **Wrong**

C $\{w \mid w$ is a string that does not contain exactly two 0's$\}$ — Correct Option

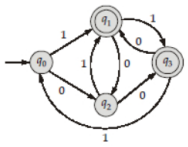
Solution :
(c)
The given DFA accepts all the strings that does not contain exactly two 0's.

D $\{w \mid w$ is a string that does not contain more than four 0's$\}$

QUESTION ANALYTICS +

Q. 3 FAQ | Solution Video | Have any Doubt ?

Consider the following DFA:



Which of the following string is not accepted by above DFA?

A 1000101

B 0100001

C 001100

D 10110100 — Your answer is **Correct**

Solution :
(d)
A string is set to be accepted if ON reading a string control of DFA reaches to some final state.
(a) Accepted
(b) Accepted
(c) Accepted
(d) Not accepted

QUESTION ANALYTICS +

Q. 4 ? FAQ ▶ Solution Video Have any Doubt ?

Consider L be the set of all strings ending with at least n − 1 a's. What is the minimum number of states in a NFA that accepts L?

A $n-1$

B n Your answer is **Correct**

Solution :
(b)
These kinds of problems can be easily done if we take small instance and let the ideal to come but of it. The number of states for minimum NFA that ends with 2 at least a's required 3 states.

Therefore, for ending with at least $n-1$ a's requires n states.

C $n+1$

D 2^n

QUESTION ANALYTICS +

Q. 5 ? FAQ ▶ Solution Video Have any Doubt ?

Consider the following statements:
I. If L is the language accepted by some DPDA, then L has an unambiguous CFG.
II. PDA with acceptance by final state is equivalent to PDA with acceptance by empty stack.
Which of the above statements is correct?

A I only

B II only

C Both I and II Correct Option

Solution :
(c)
If L is accepted by some DPDA then L must be deterministic context free language. The grammar that generates L will be deterministic context free grammar.
Also, A DCFG is the same as are LF(O) grammar. All LR(K) grammars are unambiguous. Hence Statement-1 is true. Statement-2 is true because PDA with final state has same expressive power as that of PDA with empty stack.

D None of the above Your answer is **Wrong**

QUESTION ANALYTICS +

Q. 6 ? FAQ ▶ Solution Video Have any Doubt ?

Consider the following statements are true.
I. Every left-recursive grammar can be converted to a right-recursive grammar and vice-versa.
II. All ∈ productions can be removed from any context free grammar by suitable transformations.
III. The derivation trees of strings generated by a context-free grammar in Chomsky Normal Form are always binary trees.
The number of the above statements correct is/are _____.

2 Your answer is **Correct2**

Solution :
2
• Statements I and III are correct.
• Statements II is incorrect because we cannot remove all epsilon productions from a grammar if the language contains epsilon as a word, but if it does not we can remove all.

QUESTION ANALYTICS +

Q. 7 ? FAQ ▶ Solution Video Have any Doubt ?

Let Σ = {a, b, c, d}. Then number of strings are there in Σ^5 is _____.

1024 — Correct Option

Solution :
1024
Σ^5 represents the strings of length exactly equals to 5 with all possible given alphabets. Number of alphabets are 4.
Thus,
4 × 4 × 4 × 4 × 4 choices
at every position i.e. 1024

Your Answer is 256

QUESTION ANALYTICS +

Q. 8 ? FAQ | Solution Video | Have any Doubt ?

Which of the following is/are true?

A. The class of Mealy Machine has higher power than the class of Moore machine. — Your answer is **Wrong**

B. The class of DPDA has strictly less power compared to the class of NPDA. — Correct Option

C. A regular language L_1 has 5 states in its minimal DFA, then the complement of L_1 will also have 5 states in its minimal DFA. — Your option is **Correct**

D. A context free language L_2 has 4 states in its PDA. The complement of L_2 will also have 4 states in its PDA. — Your answer is **Wrong**

YOUR ANSWER - a,c,d | CORRECT ANSWER - b,c | STATUS - ✗

Solution :
(b, c)
(a) This statement is false, because Mealy and Moore can be converted into one another, hence both have same power.
(b) This statement is true.
(c) This is true, in complementing a DFA we just change starting state to final state and viceversa, hence the total number of states remains the same.
(d) This is false, because complement of CFL doesn't need to be CFL. So it is possible that PDA may not be possible because CFL is not closed under complement.

QUESTION ANALYTICS +

Q. 9 ? FAQ | Solution Video | Have any Doubt ?

Consider the regular expression:
R = (ab | abb)*bbab
Which of the following string in not in the set denoted by R?

A. abbabbbab — Your answer is **Wrong**

B. abbababbbab — Your answer is **Wrong**

C. abababababababababab — Correct Option

D. abababbbab — Correct Option

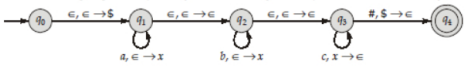
YOUR ANSWER - a,b | CORRECT ANSWER - c,d | STATUS - ✗

Solution :
(c, d)

QUESTION ANALYTICS +

Q. 10 ? FAQ | Solution Video | Have any Doubt ?

What is the language accepted by the following PDA? (Let # be the end of symbol)



A. $\{a^i b^j c^k \mid i, j, k \geq 0\}$

B. $\{a^i b^i c^i \mid i \geq 0\}$

C. $\{a^i b^i c^{2i} \mid i \geq 0\}$

D. $\{a^i b^i c^{i+j} \mid i, j \geq 0\}$ — Your answer is **Correct**

Solution :
(d)
If we see the machine, so whenever we encounter.
$a \rightarrow$ Push x
then $b \rightarrow$ Push x
then $c \rightarrow$ Pop x
Now end of tape (#) and top of stack is \$ then go to final state.
So the machine accepts the language $\{a^i b^j c^{i+j} \mid i, j \geq 0\}$.
Hence, (d) is the correct answer.

QUESTION ANALYTICS +

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Q. 11

FAQ | Solution Video | Have any Doubt ?

What is the language accepted by the following grammar?
$S \rightarrow AB \mid BA \mid A \mid B$
$A \rightarrow aAa \mid aAb \mid bAa \mid bAb \mid a$
$B \rightarrow aBa \mid aBb \mid bBa \mid bBb \mid b$

A $\{w \mid w \in \{a, b\}^+\}$ — Your answer is **Wrong**

B $\{w \mid w$ is of form xx^r or w is an odd length string, when $x \in \{a, b\}^+$ and x^r represents reverse of string $x\}$

C $\{w \mid w$ is not of form xx, where $x \in \{a, b\}^+\}$ — Correct Option

Solution :
(c)
Take a simple string i.e., generated by the grammar. Let us take $x = 'a'$. Now, make string $xx = 'aa'$ and check if xx is generated by the grammar. The answer is NO.
If any string say for "x" generated by the grammar then "xx" is not generated by the same grammar.
Hence, option (c) is correct answer.

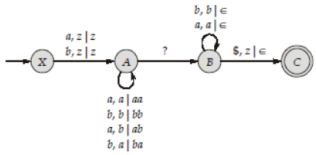
D $\{w \mid w$ is a palindrome $\mid$

QUESTION ANALYTICS +

Q. 12

FAQ | Solution Video | Have any Doubt ?

What is the missing part (?) in given PDA so that it is equivalent to $L = \{W \mid W \in \Sigma^*, \Sigma = \{a, b\}, W$ is palindrome of odd length$\}$?

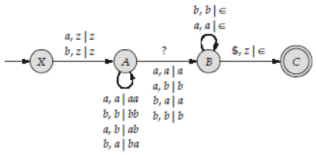


A
$a, a \mid a$
$a, b \mid b$
$b, a \mid \in$
$b, b \mid \in$

B — Your answer is **Wrong**
$a, a \mid \in$
$a, b \mid \in$
$b, a \mid \in$
$b, b \mid b$

C — Correct Option
$a, a \mid a$
$a, b \mid b$
$b, a \mid a$
$b, b \mid b$

Solution :
(c)



Since, language containing all those strings that are odd palindrome that too with no special symbol in between thus we need to check each and every symbol whether to take transition from A to A or A to B state.
Example: $b\ a\ b$
- For first b, push onto stack.
- For second a, skip.
- For third b, pop if top of stack is b.

D
$a, a \mid aa$
$a, b \mid ab$
$b, a \mid ba$
$b, b \mid bb$

QUESTION ANALYTICS +

Q. 13 ? FAQ ▶ Solution Video Have any Doubt ?

Let L_1 be the language corresponding to the regular expression (0 + 1)* 001* and L_2 be the language corresponding to the regular expression 110(1 + 0)*. Which of the following is the regular expression corresponding to the language $L_1 \cap L_2$?

A (0 + 1)* 00110(1 – 10)*

B 110(1 + 0)* 001* Your answer is **Wrong**

C 110001*

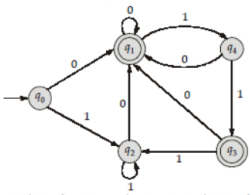
D None of the above Correct Option

Solution :
(d)
None of the option accepts 1100.

QUESTION ANALYTICS +

Q. 14 ? FAQ Have any Doubt ?

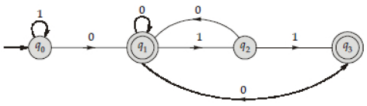
Consider the following DFA:



The number of states in the minimized DFA of the above DFA will be _____.

4 Your answer is **Correct4**

Solution :
4
If we see then we found that it either accepts all the strings that ends with "0" or the string that ends with "011". So lets draw the DFA.



So, total 4 states in the minimized DFA.

QUESTION ANALYTICS +

Q. 15 ? FAQ ▶ Solution Video Have any Doubt ?

Consider the following regular expressions:
1. (01)*0 = 0(10)*
2. (0 + 1)*01(0 + 1)* + 1*0* = (0 + 1)*
3. (0 + 1)*0(0 + 1)*1(0 + 1)* = (0 + 1)*01(0 + 1)*
4. (0 + 1)* = 0* + 1* = (0* + 1*)*

The number of the above regular expressions correct is/are _____.

3 Your answer is **Correct3**

Solution :
3
1. (01)*0 = 0(10)* is correct.
2. (0 + 1)* 01(0 + 1)* + 1*0* = (0 + 1)* is correct.
3. (0 + 1)*0(0 + 1)*1(0 + 1)* = (0 + 1)*01(0 + 1)* is correct.
4. (0 + 1)* = 0* + 1* is incorrect.
(0 + 1)* = (0* + 1*)* is correct.
So, only 3 regular expressions are correct.

QUESTION ANALYTICS +

Q. 16 ? FAQ ▶ Solution Video Have any Doubt ?

Consider a Language L_1 which is Regular and L_2 which is DCFL. We perform the following operations on these languages.

$L_3 = L_1 \cup L_2$
$L_4 = L_3'$
$L_5 = L_4 \cap L_1$

$L_6 = L_5 - L_1$
$L_6 = L_5 \cup L_2$
$L_7 = L_6 \cup L_1$
The resultant language we get in L_7 is/are (choose all possible options)

A Regular — Your answer is **Wrong**

B DCFL — Your answer is **Wrong**

C CFL — Your option is **Correct**

D CSL — Your option is **Correct**

YOUR ANSWER - a,b,c,d | CORRECT ANSWER - c,d | STATUS -

Solution :

(c, d)

$L_3 = L_1 \cup L_2 \Rightarrow L_3$ is DCFL
$L_4 = L_3' \Rightarrow L_4$ is DCFL
$L_5 = L_4 \cap L_1 \Rightarrow L_5$ is DCFL
$L_6 = L_5 - L_1 \Rightarrow L_6$ is DCFL
$L_6 = L_5 \cup L_2 \Rightarrow L_6$ is CFL
$L_7 = L_6 \cup L_1 \Rightarrow L_7$ is CFL
Thus, (c) and (d) are true.

QUESTION ANALYTICS +

Q. 17 FAQ | Solution Video | Have any Doubt ?

Consider the two languages L_1 and L_2 where L_1 is regular and L_2 is DCFL. Then the language $L_3 = (L_1 \cap L_2^*)'$ is/are true about L_3?

A CSL — Correct Option

B CFL — Your answer is **Wrong**

C Recursive — Your option is **Correct**

D Recursively enumerable — Correct Option

YOUR ANSWER - b,c | CORRECT ANSWER - a,c,d | STATUS -

Solution :

(a, c, d)

$L_3 = (L_1 \cap L_2^*)' = (\text{DCFL}^* \cap \text{Regular})'$
$= (\text{Regular} \cap \text{CFL})'$
$= (\text{CFL})' = \text{CSL}$ {using the closure property}

QUESTION ANALYTICS +

Kunal Jha
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THEORY OF COMPUTATION-2: (GATE - 2021) - REPORTS

OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(17) | CORRECT(0) | INCORRECT(0) | SKIPPED(17)

Q. 1 Solution Video | Have any Doubt ?

Which of the following grammars are in Chomsky Normal Form :

A. $S \rightarrow AB \mid BC \mid CD, A \rightarrow 0, B \rightarrow 1, C \rightarrow 2, D \rightarrow 3$ — Correct Option

Solution :
(a)
- Chomsky normal format is $S \rightarrow AB$ or $S \rightarrow a \mid b$.
- Option (a) correctly suits the Chomsky Normal Form.
- Option (b), $S \rightarrow BCA$ violates the CNF form.
- Option (c), $S \rightarrow ABa$, $A \rightarrow aab$, $B \rightarrow Ac$ violates the CNF form.

B. $S \rightarrow AB, S \rightarrow BCA, A \rightarrow 0 \mid 1 \mid 2 \mid 3$

C. $S \rightarrow ABa, A \rightarrow aab, B \rightarrow Ac$

D. All of the above

QUESTION ANALYTICS +

Q. 2 FAQ | Solution Video | Have any Doubt ?

Consider the following languages :
$A = \{a^n b^m \mid n, m \geq 0\}$
$B = \{a^n b^m \mid n \geq m \geq 0\}$
$C = \{a^n b^m \mid n = m \geq 0\}$
$D = \{a^n b^m \mid n \geq m \leq 100\}$
Which of the above are not regular?

A. Only A and D

B. Only B and C — Correct Option

Solution :
(b)
- A is regular. (Since $\{a^n b^m \mid n, m > 0\}$ corresponds to regular expression $a^* b^*$. Thus, it is regular.
- B is not regular.
- C is not regular.
- D is regular. (Since $\{a^n b^m \mid n \geq m \leq 100\}$ is finite language and all finite languages are regular.

So, B and C are not regular.

C. Only C

D. Only A and B

QUESTION ANALYTICS +

Q. 3 FAQ | Solution Video | Have any Doubt ?

Consider the following languages :
$L_1 = \{0^p 1^q 0^r \mid p, q, r \geq 0\}$
$L_2 = \{0^p 1^q 0^r \mid p, q, r \geq 0, p \neq r\}$
Which one of the following statements is FALSE?

A. L_2 is context-free

B. L_1 intersection L_2 is context-free

C. Complement of L_2 is recursive

D. Complement of L_1 is context-free but not regular — Correct Option

Solution :
(d)
- L_1 is regular so complement of L_1 will also be regular.
- L_2 is context-free so complement of L_2 will not be context-free and is recursive.
- $L_1 \cap L_2$ is CFL but not regular.

QUESTION ANALYTICS +

Q. 4 Solution Video | Have any Doubt ?

Consider the language L_1, L_2, L_3 as given below:
$L_1 = \{0^p 1^q \mid p, q \geq 0\}$
$L_2 = \{0^p 1^q \mid p, q \geq 0 \text{ and } p = q\}$
$L_3 = \{0^p 1^q 0^r \mid p, q, r \geq 0 \text{ and } p = q = r\}$
Which of the following statements is NOT true?

A Push down automata (PDA) can be used to recognize L_1 and L_2.

B L_1 is regular language.

C L_3 is regular language. Correct Option

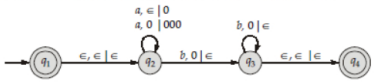
Solution :
(c)
Language L_1 is regular since, it represents $0^* 1^*$.
Language L_2 is CFL since, it involves one comparison. And, language L_3 is CSL since, it involves two comparison at a time.
Hence, option (a) is true since PDA can be used to recognize both L_1 and L_2 since they are regular and CFL respectively.
Clearly, option (c) is false.

D None of the above

QUESTION ANALYTICS +

Q. 5 FAQ | Solution Video | Have any Doubt ?

Which of the following language is accepted by given PDA?



A $\{a^n \mid n \geq 0\}$

B $\{a^n b^{2n-1} \mid n \geq 1\}$

C $\{a^n b^{2n} - 1 \mid n \geq 1)\} \cup \in$

D $\{a^n b^{2n-1} \mid n \geq 1)\} \cup \in$ Correct Option

Solution :
(d)
q_1 shows $\in$ can be accepted. If we see the PDA, for first 'a', we push one zero into the stack and for each 'a' later on, we push two zeroes into stack.
Hence, $\{a^n b^{2n-1} \mid n \geq 1)\} \cup \in$ is correct expression.

QUESTION ANALYTICS +

Q. 6 Solution Video | Have any Doubt ?

Consider the below statement about Rice theorem.
I. Rice theorem can be used to show that a language is decidable.
II. Rice theorem can be used to show that a language is undecidable.
III. Rice theorem implies that there are infinitely many undecidable languages.
IV. Rice theorem implies that there are only finitely many undecidable languages.
The number of the above correct statements is/are _____.

2 Correct Option

Solution :
2
• Statement 2 and 3 are correct, i.e., Rice theorem can be used to show that a language is undecidable.
• Rice theorem implies that there are infinitely many undecidable languages.

QUESTION ANALYTICS +

Q. 7 FAQ | Solution Video | Have any Doubt ?

Consider the following languages:
I. $A = \{x \mid x$ has two 0's separated by the string whose length is multiple of 4$\}$.

II. $B = \{x \mid x$ is a binary representation of multiple of 3$\}$
III. $C = \{x \mid x$ is a binary string and decimal of any prefix of x is not of form $3m + 2$, where $m \geq 0\}$
The number of the correct statements, i.e., regular is/are _____.

3 — Correct Option

Solution :
3
All (I), (II) and (III) are regular.

QUESTION ANALYTICS +

Q. 8 ? FAQ | Solution Video | Have any Doubt ?

Which of the following statements is/are true?

A. DCFL's are closed under complement — Correct Option
B. DCFL's are closed under Homomorphism
C. DCFL's are closed under union with regular — Correct Option
D. Regular language closed under infinite union.

YOUR ANSWER - NA | CORRECT ANSWER - a,c | STATUS - SKIPPED

Solution :
(a, c)
(a) True
(b) DCFL are closed under inverse homomorphism. Hence False
(c) Union, intersection and subtraction with regular is always closed. Hence True
(d) Regular languages are not closed under infinite union. Hence false

QUESTION ANALYTICS +

Q. 9 ? FAQ | Solution Video | Have any Doubt ?

If L_1 is DCFL and L_2 is CFL, then which statement is/are true:

A. $L_1 - L_2$ is CFL
B. $L_1 - L_2$ is CSL — Correct Option
C. $L_2 - L_1$ is CFL
D. $L_2 - L_1$ is CSL — Correct Option

YOUR ANSWER - NA | CORRECT ANSWER - b,d | STATUS - SKIPPED

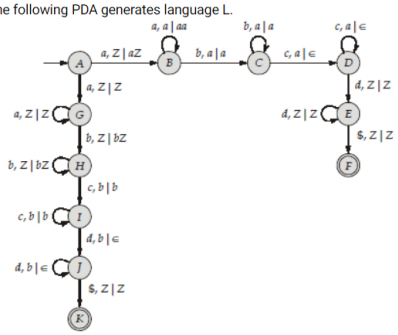
Solution :
(b, d)

$= L_1 - L_2 = L_1 \cap \overline{L_2} = \text{DCFL} \cap \overline{\text{CFL}}$
$= \text{DCFL} \cap \text{CSL} = \text{CSL}$
$= L_2 - L_1 = L_2 \cap \overline{L_1} = \text{CFL} \cap \overline{\text{DCFL}}$
$= \text{CFL} \cap \text{DCFL}$
$= \text{CFL} \cap \text{CFL} = \text{CSL}$

QUESTION ANALYTICS +

Q. 10 ? FAQ | Solution Video | Have any Doubt ?

Consider the following PDA generates language L.



Which of the following is correct?

A $L = \{a^i b^j c^k d^l \mid i = k \text{ and } j = l, i, j, k \geq 1\}$

B $L = \{a^i b^j c^k d^l \mid i = j \text{ and } k = l, i, j, k \geq 1\}$

C $L = \{a^i b^j c^k d^l \mid i = k \text{ or } j = l, i, j, k \geq 1\}$ Correct Option

Solution :
(c)
Option (c) is the correct answer.

D None of these

QUESTION ANALYTICS +

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Q. 11

FAQ | Solution Video | Have any Doubt ?

Consider the pushdown automation (PDA) below which runs over the input alphabet (a, b, c). It has the slack alphabet $\{Z_o, X\}$ where Z_o is the bottom-of-stack marker. The set of states of the PDA is $\{s, t, u, f\}$ where s is the start state and f is the final state. The transitions of the PDA given below are depicted in a standard manner. For example, the transition $(S, b, X) \rightarrow (t, XZ_o)$ means that if the PDA is in states and the symbol on the top of the stack is X, then it can read b from the input and move to state t after popping the top of stack and pushing the symbols Z_o and X (in that order) on the stack.

$(S, \in, Z_o) \rightarrow (f, \in)$
$(S, a, Z_o) \rightarrow (S, XXZ_o)$
$(S, a, x) \rightarrow (S, XXX)$
$(S, b, X) \rightarrow (t, \in)$
$(t, b, X) \rightarrow (t, \in)$
$(t, c, X) \rightarrow (u, \in)$
$(u, c, X) \rightarrow (u, \in)$
$(u, \in, Z_o) \rightarrow (f, \in)$

The language accepted by the PDA is

A $\{a^l b^m c^n \mid l = m = n\}$

B $\{a^l b^m c^n \mid l = m\}$

C $\{a^l b^m c^n \mid 2l = m + n\}$ — Correct Option

Solution :
(c)
If we see the transition then we can observe things as follows :
(i) When we are at state 'S', and if we encounter 'a' then we are pushing two 'X'.
(ii) At state 'S', if we encounter input symbol 'b' and top of stack symbol is X, then we are deleting top of stock and move to state 't'.
(iii) At state 't', we do the same thing as shown in (ii) step and remain at 't' state. Similarly, if we observe 'c' at 't' state then we pop the stack symbol and move to new state and does the same if 'c' is encounter.
So, in conclusion for 'a' 2 'X' is pushed and for every 'b' or 'c' 1 'X' is popped.
So, language is $\{a^l b^m c^n \mid 2l = m + n\}$.
So, option (c) is correct.

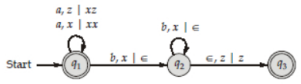
D $\{a^l b^m c^n \mid m = n\}$

QUESTION ANALYTICS +

Q. 12

FAQ | Solution Video | Have any Doubt ?

Consider the transition diagram of a PDA given below with input alphabet $\Sigma = \{a, b\}$ and stack alphabet $\tau = \{X, Z\}$. Z is the initial stack symbol. This PDA accepts by final state. Let L denote the language accepted by the PDA. Which one of the following is TRUE?



A $L = \{a^n b^n \mid n \geq 0\}$ and is not accepted by any finite automata.

B $L = \{a^n b^n \mid n \geq 0\} \cup \{a^n \mid n > 0\}$ and is not accepted by any PDA.

C $L = \{a^n b^n \mid n \geq 0\} \cup \{a^n \mid n \geq 0\}$ and is context-free. — Correct Option

Solution :
(c)
The given machine is of PDA. So, surely it will be context free.
Now, the machine accepts the language

$$L = \{a^n b^n \mid n \geq 0\} \cup \{a^n \mid n \geq 0\}$$

So, option (c) is correct answer.

D None of these

QUESTION ANALYTICS +

Q. 13

FAQ | Solution Video | Have any Doubt ?

Which of the following are CFLs?
$A = \{xwx^r \mid x, w \in \Sigma^*, |x| = |w|\}$
$B = \{x\$w \mid w \text{ is a substring of } x, x \in \Sigma^*, \$ \in \Sigma\}$

A Only A

B Only B

C Both A and B

D None of them — Correct Option

Solution :
(d)
• Both A and B are not CFLs.
• Checking substring in B is not CFL. Because in PDA we uses single stack.

QUESTION ANALYTICS +

Q. 14 FAQ | Solution Video | Have any Doubt ?

Consider the following statements which of the following languages over {0, 1}* satisfy the property that if x belongs to the language then xx also belongs to the language? (dec(x) represents the decimal equivalent of a binary string x).

I. $\{x \mid \text{dec}(x) \text{ is a prime}\}$
II. $\{x \mid \text{dec}(x) \text{ is a composite number} > 1\}$
III. $\{x \mid x \text{ is a palindrome}\}$
IV. $\{x \mid \text{dec}(x) \text{ is divisible by } 3\}$

The number of the statements satisfies the mentioned property is _____.

3 — Correct Option

Solution :
3
- Statement II, III and IV satisfies the property.
- If we check, statement I take a string x 101 i.e., decimal 5 which is prime but xx = 101101, i.e., decimal 45 which is not prime. Hence, xx is not in the language.

QUESTION ANALYTICS +

Q. 15 FAQ | Solution Video | Have any Doubt ?

Consider the following languages:
1. $A = \{ww^r w^r w \mid w \in \Sigma^*\}$
2. $B = \{ww^r xx^r \mid w, x \in \Sigma^*\}$
3. $C = \{a^i b^j a^k b^l \mid i, j, k, l \geq 0, (i + j) = (k + 1)\}$

The number of the above languages which is CFL's is/are _____.

2 — Correct Option

Solution :
2
- Only B and C are CFLs.
- In language C, Push and Pop is clear means
  - Input a, Tos \$ | $a \rightarrow$ Push x
  - Input b, Tos \$ | a | $b \rightarrow$ Push x
  - Input a, Tos \$ | a | $b \rightarrow$ Pop x
  - Input b, Tos \$ | a | $b \rightarrow$ Pop x
  - Input completed, Tos \$ $\rightarrow$ String accepted
- Language B, can be broken down as ww^r and xx^r and its concatenation represents language B.

  Let $L_1 = ww^r$ (CFL)
  $L_2 = xx^r$ (CFL)

  Thus, B is CFL since B = L_1 . L_2 and contexts free languages are closed under concatenation.

QUESTION ANALYTICS +

Q. 16 FAQ | Solution Video | Have any Doubt ?

How many of the following statement(s) is/are decidable?

A The intersection of two regular languages. — Correct Option

B Whether a given context free language is regular or not.

C Whether a given grammar is context free. — Correct Option

D Finiteness problem of regular language. — Correct Option

YOUR ANSWER - NA | CORRECT ANSWER - a,c,d | STATUS - SKIPPED

Solution :

(a, c, d)
The intersection of two regular languages is infinite is decidable.
Whether a given context free language is regular is not decidable.
Whether a given grammar is context free is decidable.
Finiteness problem of regular language is decidable.

QUESTION ANALYTICS +

Q. 17

? FAQ | Solution Video | Have any Doubt ?

Consider the following problems:
(a) L is a context sensitive language (CSL), complement of L is of same type.
(b) Let L_1 and L_2 is CSL, intersection of L_1 and L_2 is empty or not.
(c) Finiteness problem in CFGs.
(d) Emptiness problem for CFGs
Which of the following problems is/are decidable?

A a — Correct Option

B b

C c — Correct Option

D d — Correct Option

YOUR ANSWER - NA | CORRECT ANSWER - a,c,d | STATUS - SKIPPED

Solution :
(a, c, d)

QUESTION ANALYTICS +

Kunal Jha
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Computer Science Engineering(CS)

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OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(33) CORRECT(0) INCORRECT(0) SKIPPED(33)

Q. 1 FAQ | Have any Doubt ?

Let L_1 and L_2 be languages such that there exist a DFA for accepting $L_1 \cup L_2$. Which of the following statements is necessarily true?

A. There must be a DFA for $L_1 \cap L_2$

B. There cannot be a DFA L_1

C. There must be a DFA for either L_1 or L_2

D. None of the above — Correct Option

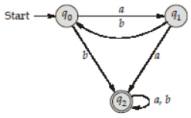
Solution :
(d)

Consider $L_1 = \{a^n b^m \mid n = m\}$
and $L_2 = \{a^n b^m \mid n \neq m\}$
then $L_1 \cap L_2 = \phi$
and $L_1 \cup L_2 = a^* b^*$
Since there exits a DFA for $L_1 \cup L_2$
Hence option (b) is false.
Option (c) is also false since for both L_1 and L_2 there does not exits any DFA.
Now, In order to verify option (a)
Consider $L_1 = a^* b^*$
$L_2 = \{a^n b^m \mid n = m\}$
then, $L_1 \cap L_2 = \{a^n b^m \mid n = m\}$
and $L_1 \cup L_2 = a^* b^*$
Clearly, no DFA exists for $L_1 \cap L_2$
Here option (a) is also false.
Therefore, (d) is the only choice.

QUESTION ANALYTICS +

Q. 2 Have any Doubt ?

Which of the following is the transition table of the given DFA?



A. — Correct Option

		a	b
→	q_0	q_1	q_2
	q_1	q_2	q_0
*	q_2	q_2	q_2

Solution :
(a)

B.

		a	b
→	q_0	q_1	q_1
	q_1	q_2	q_2
*	q_2	q_0	q_0

C.

		a	b
→	q_0	q_1	q_2
	q_1	q_2	q_1
*	q_2	q_0	q_2

D.

		a	b
→	q_0	q_2	q_1
	q_1	q_0	q_2
*	q_2	q_2	q_2

QUESTION ANALYTICS +

Q. 3 FAQ | Have any Doubt ?

The PDA $M = (\{q_0, q_1, q_2\}, \{a, b\}, \{0, 1\}, \delta, q_0, 0, \{q_0\})$ with $\delta(q_0, a, 0) = \{q_1, 10\}$, $\delta\{q_1, a, 1\} = \{q_1, 11\}$, $\delta\{q_1, b, 1) = \{q_2, \lambda\}$, $\delta(q_2, b, 1) = \{q_2, \lambda\}$, $\delta(q_2, \lambda, 0) = \{q_0, 0\}$. Which of the following accepts the language?

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

B $L = \{a^n b^n \mid n \geq 0\}$ Correct Option

Solution :
(b)

C $L = \{a^n b^m \mid n, m > 0\}$

D $L = \{a^n b^n \mid n > 0\}$

QUESTION ANALYTICS +

Q. 4 Have any Doubt ?

Consider the following grammars:
$G_1 = \{S \rightarrow a, S \rightarrow AZ, A \rightarrow a, Z \rightarrow z\}$
$G_2 = \{S \rightarrow a, S \rightarrow aZ, Z \rightarrow a\}$
Which of G1, G2 are in CNF (Chomsky Normal Form)?

A G_1 Correct Option

Solution :
(a)
In formal language theory, a context - free grammar, G, is said to be in chomsky normal form if all of its production rule are of the form

$A \rightarrow BC$

or $A \rightarrow a$

Hence, only G_1 is in CNF.

B G_2

C Both

D None

QUESTION ANALYTICS +

Q. 5 FAQ Have any Doubt ?

Let $L = \{wkw^r \mid w \in \{a, b\}^*\}$ where w^r is reverse of w and $\Sigma = \{a, b, k\}$. Is L accepted by any PDA?

A Yes Correct Option

Solution :
(a)

B No

C Depends on k

D None of these

QUESTION ANALYTICS +

Q. 6 FAQ Have any Doubt ?

A Turing machine is expressed as a 7-tuple $(Q, \Sigma, \Gamma, \delta, q_0, B, F)$ where Γ is complete set of tape symbols and Σ is finite set of input symbols then what is always true?

A $\Gamma \subseteq \Sigma$

B $\Sigma \subseteq \Gamma$ - {Blank symbol} Correct Option

Solution :
(b)

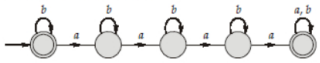
C $\Sigma = \Gamma$

D None of the above

QUESTION ANALYTICS +

Q. 7 Have any Doubt ?

Let M be a DFA given below:



Let $L(M)$ be the language generated by the above DFA. Then the complement of $L(M)$ is

A $\{w \mid n_a(w) \leq 3, w \in (a, b)^*\}$

B $\{w \mid n_a(w) \geq 3, w \in (a, b)^*\}$

C $\{w \mid n_a(w) = 2, w \in (a, b)^*\}$

D $\{w \mid n_a(w) \geq 1, w \in (a, b)^*\} \cap \{w \mid n_a(w) \leq 3, w \in (a, b)^*\}$ Correct Option

Solution :
(d)

$$L(M) = \{w \mid n_a(w) = 0 \text{ or } n_a(w) \geq 4\}$$

$$\overline{L(M)} = L(\bar{M}) = \{w \mid 1 \leq n_a(w) \leq 3\}$$

So, option (d) is correct.

QUESTION ANALYTICS +

Q. 8 FAQ Have any Doubt ?

Consider the language L_1 and L_2:

$L_1 = \{ww \mid w \in (a, b)^*\}$

$L_2 = \overline{L_1}$

Which of the following is most strongest answer?

A Both L_1 and L_2 is CFL

B Both L_1 and L_2 is CSL

C L_1 is CSL and L_2 is CFL Correct Option

Solution :
(c)

- L_1 is well known CSL.
- L_2 is a CFG for L_2 given below.

$S \to A \mid B \mid AB \mid BA$

$A \to a \mid aAb \mid aAa \mid bAb \mid bAa$

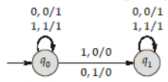
$B \to b \mid aBa \mid aBb \mid bBb \mid bBa$

D L_1 is CSL and L_2 is Recursive Language

QUESTION ANALYTICS +

Q. 9 FAQ Have any Doubt ?

Consider the following Mealy Machine:



The boolean function computed by the above Mealy Machine M(α, β) when α = β = 0 is _____.

1 Correct Option

Solution :
1

The given Mealy machine computes XNOR.

So, $\alpha \odot \beta = \overline{\alpha \oplus \beta} = \overline{0 \oplus 0} = 1$

QUESTION ANALYTICS +

Q. 10 FAQ Have any Doubt ?

Consider two languages L_1 and L_2 on the Unary alphabet {O}, such that $L_1 = OO^* + \in$ and

$L_2 = \{O^K \mid K$ is square of a natural number$\}$. Then $L_1 \cup L_2$ is

I. Regular
II. CFL
III. CSL
The number of correct statements is/are _____.

3 Correct Option

Solution :
3

$$L_1 = OO^* + \in$$
$$L_2 = \{O^K \mid K \text{ is square}\}$$
$$L_1 \cup L_2 = O^*$$

Hence, it is regular.
Subsequently will be CFL and CSL.

QUESTION ANALYTICS +

Kunal Jha
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Computer Science Engineering(CS)

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ALL(33) | CORRECT(0) | INCORRECT(0) | SKIPPED(33)

Q. 11

FAQ | Have any Doubt ?

Let r and s be two regular expressions on the alphabet {0, 1}.

$r = 10(0 + 1)^*$

$s = (0 + 1)^*1$

Let X be another language such that $L(X) = \{L(r)^R \cup L(s)\}$. Then the number of states in the minimal DFA which accepts X is _____.

2 — Correct Option

Solution :

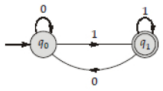
2

$L(r)$ represents set of all strings starting with 10.

$L(s)$ represents set of all strings ending with 1.

$L(r)^R$ represents set of all strings ending with 01.

Here, $L(r)^R \cup L(s)$ = set of all strings ending with 1.



QUESTION ANALYTICS +

Q. 12

FAQ | Have any Doubt ?

Assume the powers of a string w over the concatenation operation (.) as follows:

$w^0 = \in$

$w^{i+1} = w^i.w$

The number of states in the minimal DFA (over the unary alphabet {1}) of the language corresponding to the regular expression $(1^3 + 1^{2013})^* + (1^6 + 1^{2022})^*$ is equal to _____.

3 — Correct Option

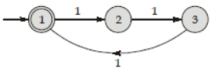
Solution :

3

The regular expression is $(1^3 + 1^{2013})^* + (1^6 + 1^{2022})^*$

$= (1^3)^* + (1^6)^*$

$= (111)^* + (111111)^* = (111)^*$



Hence, only 3 states is required.

QUESTION ANALYTICS +

Q. 13

FAQ | Have any Doubt ?

Let l, m, n be 3 regular expressions. Consider the following identities.

I. $(l^*m^*n^*)^* = (lm^* + mn^* + nl^*)^*$

II. $(l^*m^*n^*)^* = (l^* + m^*n + n^*)^*$

III. $(l^*m)^* = (l + m)^*$

How many of the above identities is/are correct? _____.

1 — Correct Option

Solution :

1

- I is correct.

  L.H.S. $= (l + m + n)^*$

  R.H.S. $= (l + m + n + ...)^*$

  We get l, m and n separately.

  R.H.S. is equal to $(l + m + n)^*$

  Therefore, 1 is true.
- II is false, as we can not get 'm' separately in R.H.S.
- III is false, as we can not get 'l' separately in L.H.S.

QUESTION ANALYTICS +

Q. 14

FAQ | Have any Doubt ?

Consider the following statements. Which of the below are correct?

A Over the unary alphabet, every context free language is regular. Correct Option

B Over the unary alphabet, every context sensitive language is regular.

C The reversal of a DCFL is always context free. Correct Option

D None of these

YOUR ANSWER - NA | CORRECT ANSWER - a,c | STATUS - SKIPPED

Solution :

(a, c)
- Statement (a) and (c) are correct.
- (b) is false because {aP; P is prime} is not-regular CSL.

QUESTION ANALYTICS +

Q. 15 FAQ Have any Doubt ?

Consider the following statements regarding grammars. Which of the below are correct?

A If a grammar G has $\in$ productions, then $\in$ is a member of $L(G)$.

B If a grammar G has no $\in$ production, then $\in$ is not a member of $L(G)$. Correct Option

C If $\in$ is not a member of $L(G)$, then G has no $\in$ productions.

D A finite language can have $\in$ production in its grammar. Correct Option

YOUR ANSWER - NA | CORRECT ANSWER - b,d | STATUS - SKIPPED

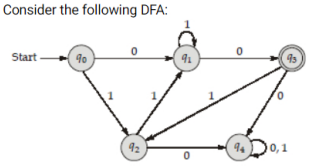
Solution :

(b, d)
- Only statement (b) and (d) are correct.
- (a) is incorrect. Example : $S \to aA, A \to \in$
  Clearly, G has $\in$ production however $\in$ is still not a number of $L(G)$, as G only generates the string 'a'.
- (c) is the contrapositive hence (c) is also false.

QUESTION ANALYTICS +

Q. 16 FAQ Have any Doubt ?

Consider the following DFA:



Consider the following strings. Which of these below string accepted by the DFA?

A 011110 Correct Option

B 101011

C 010110 Correct Option

D 1110110 Correct Option

YOUR ANSWER - NA | CORRECT ANSWER - a,c,d | STATUS - SKIPPED

Solution :

(a, c, d)

QUESTION ANALYTICS +

Q. 17 FAQ Have any Doubt ?

Consider the following grammars G_1 and G_2 over the alphabet {$, (,)}

$G_1 : S \to (S) \mid A; A \to \$A \mid \in$

$G_2 : S \to)S(\mid A; A \to \$A \mid \in$

Which of the following is incorrect about $L(G_1) \cap L(G_2)$?

A It satisfies pumping lemma for context free language.

B It satisfies the Kleene's theorem.

C It is infinite.

D None of these — Correct Option

Solution :
(d)

$$L(G_1) \cap L(G_2) = \$^*$$

- Hence, it is regular. So, it satisfies pumping lemma as every regular language is also CFL. It is infinite hence Kleene's theorem also satisfies.
- Hence, option (d) is correct.

QUESTION ANALYTICS +

Q. 18 FAQ | Have any Doubt ?

Let M be a finite automata. Let M denote the machine obtained by interchanging the final and non-final states in the machine M.

I. $L(M) \cup L(M') = \Sigma^*$

II. $L(M) \cap L(M') = \phi$

What is the validity of the above statements with respect to DFA's and NFA's.

A I and II always hold for DFA but may or may not hold for NFA. — Correct Option

Solution :
(a)
I and II always hold for DFA, as L(M') is same as [L(M)]'φ. However, the same is not the true for NFA.

B I and II hold for both DFA and NFA.

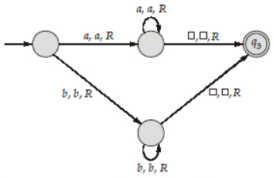
C I and II always hold for DFA but never hold for NFA.

D None of these

QUESTION ANALYTICS +

Q. 19 FAQ | Have any Doubt ?

Consider the following Turing Machine M over the alphabet $\{a, b\}$ and tape alphabet $\{a, b, \square\}$.



The language accepted by the above M is

A $\{a^n \mid n \geq 0\} \cup \{b^n \mid n \geq 0\}$

B $\{a^n \mid n \geq 1\} \cup \{b^n \mid n > 0\}$ — Correct Option

Solution :
(b)
The Turing Machine T accepts the regular language corresponding to the regular expression $aa^* + bb^*$.

C $\{a^n \mid n \geq 1\} \cup \{b^n \mid n > 1\}$

D $\{a^n \mid n \geq 1\} \cup \{b^n \mid n \geq 0\}$

QUESTION ANALYTICS +

Q. 20 FAQ | Have any Doubt ?

Let prefix (w) denote the set of all prefixes of a string (w) and suffix (w) denote the set of all suffixes of w. Let substring (w) denote the set of all substring of string (w).
Consider the following statements:

I. Prefix $(w) \cup$ suffix $(w) =$ Substring (w)

II. Prefix $(w) \cap$ suffix $(w) = \{\in, w\}$

Which of the above statements is/are true?

A I only

B II only

C Both I and II

D None of these — Correct Option

Solution :
(d)

$$w = 11011$$
$$\text{Prefix}(w) = \{\epsilon, 1, 11, 110, 1101, 11011\}$$
$$\text{Suffix}(w) = \{\epsilon, 1, 11, 011, 1011, 11011\}$$
$$\text{Prefix}(w) \cap \text{Suffix}(w) = \{\epsilon, 1, 11, \underbrace{11011}_{w}\}$$

So $\text{Prefix}(w) \cap \text{Suffix}(w) \neq \{\epsilon, w\}$

Now,

$$\text{Prefix}(w) \cap \text{Suffix}(w) = \{\epsilon, 1, 11, 110, 1101, 011, 1011, 11011\}$$
$$\text{Prefix}(w) \cup \text{Suffix}(w) \neq \text{Substring}(w)$$

because '101' substring not belong to $\text{Prefix}(w) \cup \text{Suffix}(w)$.

QUESTION ANALYTICS +

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OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(33) | CORRECT(0) | INCORRECT(0) | SKIPPED(33)

Q. 21

Have any Doubt ?

Match **List-I** and **List-II** and select correct option accordingly.

List-I	List-II
A. $b(a+b)^*b$	1. Contains all strings in which no two b's are consecutive.
B. $(a+b)^*ab^*ab^*$	2. Starts with 'a' and every 'a' is followed by atleast one 'b'.
C. $(a+ba)^*(\in+b)$	3. All the strings contains at least 2 a's.
D. $(abb^*)^*$	4. Contains strings having at least length of 2 such that string start and ends with b.

Codes :

	A	B	C	D
(a)	4	1	3	2
(b)	3	1	2	4
(c)	1	3	4	2
(d)	4	3	1	2

A a

B b

C c

D d — Correct Option

Solution :
(d)
Option (d) correct matches.

QUESTION ANALYTICS +

Q. 22

FAQ | Have any Doubt ?

Consider the following language:
I. $[w^Rx^Rw^Ry^R \mid w, x, y \in (0, 1)^*]$
II. $[xwx^R \mid w, x \in (0, 1)^*]$
III. $[wx^Rwy^R \mid w, x, y \in (0, 1)^*]$
Which of the above language is regular?

A Only II

B Only II and III

C Only I and III

D All of these — Correct Option

Solution :
(d)
- All I, II and III are regular.
- Try to avoid string matching by putting w as $\in$ and make x and y go to (0 + 1). Therefore, we are shown that the subset itself is Σ^* and thus I and II are regular.
- Now in III, put w as $\in$ and make x^R and y^R go to Σ^* (Note that no string matching between x and y). Hence, III is regular.

QUESTION ANALYTICS +

Q. 23

FAQ | Have any Doubt ?

Consider a PDA below which runs over the input alphabet $\{a, b\}$. It has the stack alphabet $\{Z_0, X\}$ where Z_0 is the bottom of stack marker. The set of states of PDA is $\{q_0, q_1\}$ and q_0 is the starting and final state.

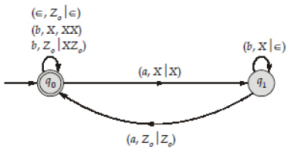
$$\delta(q_0, b, Z_0) = (q_0, XZ_0)$$
$$\delta(q_0, b, X) = (q_0, XX)$$
$$\delta(q_0, a, X) = (q_1, X)$$
$$\delta(q_0, \in, Z_0) = (q_0, \in)$$
$$\delta(q_1, b, X) = (q_1, \in)$$
$$\delta(q_1, a, Z_0) = (q_0, Z_0)$$

The language accepted by PDA is

A $L = \{(b^na b^n a)^m \mid n, m > 0\}$

B $L = \{(b^n ab^n a)^m \mid n > 0, m \geq 0\}$ Correct Option

Solution :
(b)



$L = \{(b^n ab^n a)^m \mid m, n \geq 0\}$

C $L = \{(b^n ab^n)^m a \mid n, m \geq 0\}$

D $L = \{(b^n a^n ba)^m \mid n, m \geq 0\}$

QUESTION ANALYTICS +

Q. 24 FAQ Have any Doubt ?

Consider <M> be the encoding of a Turing Machine as a string over alphabet $\Sigma = \{0, 1\}$. Consider $L = \{<M> \mid M$ is TM which halts on all the input and $L(M) = L'$ for some undecidable language $L'\}$. Then L is

A Recursive Correct Option

Solution :
(a)
Since M is a TM that halts on all input. So, $L(M)$ is decidable. So, $L(M) \neq L'$. Hence, it will be recursive too.

B Undecidable

C Decidable but Non-Recursive

D Undecidable and Recursively Enumerable

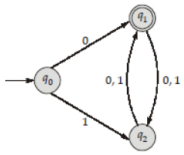
QUESTION ANALYTICS +

Q. 25 Have any Doubt ?

Consider the following language given below:
$L = \{w \mid w$ has odd length and starts with '0' or w has even length and start with '1'$\}$.
The minimum state required for equivalent DFA for L is _____.

3 Correct Option

Solution :
3



So, only 3 state required.

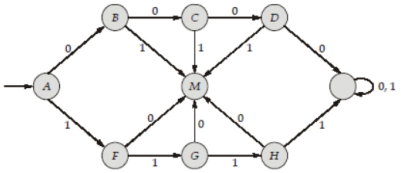
QUESTION ANALYTICS +

Q. 26 FAQ Have any Doubt ?

The number of stages in the minimal DFA of the set of strings over {0, 1} which start with 0000 or 1111 is _____.

9 Correct Option

Solution :
9

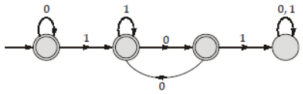


The minimal DFA has 9 states.

QUESTION ANALYTICS +

Q. 27 ? FAQ Have any Doubt ?

Let M be a deterministic finite automata as shown below:



Let S denote the set of 7-bit binary strings in which the first, the third and the last bits are 1. The number of strings in S that are accepted by M is equal to _____.

3 Correct Option

Solution :
3
The given DFA represents set of strings not containing '101' as a substring.
As given

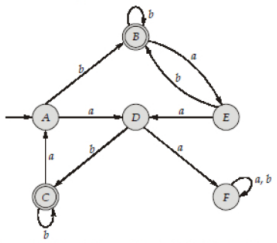
$$\underset{b_1}{1}\ \_\ \underset{b_2}{1}\ \_\ \_\ \_\ \underset{b_7}{1}$$

- b_2 will be $1 \Rightarrow 1$ ways
- $b_4b_5b_6$ can be arranged in $2 \times 2 \times 2 = 8$ ways which included 000, 010, 011, 101, 110 for $b_4b_5b_6$ which is not accepted by the DFA.
  So, right combination = 8 – 5 = 3

QUESTION ANALYTICS +

Q. 28 ? FAQ Have any Doubt ?

Consider the following DFA:



The number of states in the minimal. DFA obtained by applying minimization algorithm is equal to _____.

4 Correct Option

Solution :
4
Partition-1 : {B, C} {A, D, E, F}
Partition-2 : {B, C} {A, D, E} {F}
Partition-3 : {B, C} {A, E} {D} {F}
Partition-4 : {B, C} {A, E} {D} {F}
Total 4 states.

QUESTION ANALYTICS +

Q. 29 ? FAQ Have any Doubt ?

Consider the following language:
$L_1 = \{a^l b^{2l} a^m \mid l \geq 0 \text{ and } m \geq 0\}$
$L_2 = \{a^l b^m c^l d^m \mid l, m > 0\}$
$L_3 = \{a^l b^m a^{l+m} \mid l, m \geq 0\}$
$L_4 = \{a^l b^{2l} a^{l+m} \mid l \geq 0 \text{ and } m \geq 0\}$
The number of the above languages that can be solved using single stack in a program is/are _____.

2 Correct Option

Solution :
2
• Basically single stack means context free grammar.
• L_1 and L_3 is DCFL. Hence it is CFL which requires single stack.
• L_2 and L_4 can not be solved using single stack.

QUESTION ANALYTICS +

Q. 30 ? FAQ Have any Doubt ?

Consider the following languages:
$L_1 : \{(XY)^m x^m y^m \mid m > 0\}$
$L_2 : \{(X^*Y^*Z^* - \{X^mY^mZ^m \mid m > 0\}$

L_3 : $\{(w \in \{0, 1\}^* \mid \exists\ K \geq 0$ and w is a binary encoding of $2^K + 1\}$ also leading 0's are allowed.

The number of the above languages which are CFL is _____.

2 Correct Option

Solution :

2

- L_1 is CSL.
- L_2 is CFL.
  $L_2 = \{X^m Y^n Z^p \mid m, n, p \geq 0$ and $m \neq n$ or $m \neq p\}$
- L_3 is regular.
  $L_3 = 0^*(1 + 10^*1)$

QUESTION ANALYTICS +

Kunal Jha
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ALL(33) | CORRECT(0) | INCORRECT(0) | SKIPPED(33)

Q. 31

FAQ | Have any Doubt ?

Which of the following are correct?

A. Any deterministic Turing Machine must have at least 2 states. — Correct Option

B. A context free grammar can generate many language but vice-versa is not true.

C. Only unambiguous context free grammar can be converted into Chomsky normal form.

D. Complement of a context free language can be recognized by a Turing Machine. — Correct Option

YOUR ANSWER - NA | CORRECT ANSWER - a,d | STATUS - SKIPPED

Solution :

(a, d)
- (a) is correct.
- (b) It is incorrect, because "A context free grammar can generate only one language but a language can be generated by many grammar".
- (c) is incorrect because any CFG can be converted into CNF.
- (d) is correct.

QUESTION ANALYTICS +

Q. 32

Have any Doubt ?

Consider the following problems and select the correct options which are decidable.

A. $L_1 = \{\langle M, R\rangle \mid M \text{ is a DFA and } R \text{ is a regular expression with } L(M) = L(R)\}$ — Correct Option

B. $L_2 = \{\langle G\rangle \mid M \text{ is a CFG and } L(G) = \Sigma^*\}$

C. $L_3 = \{\langle G\rangle \mid G \text{ is CFG which generate } \in\}$ — Correct Option

D. None of these

YOUR ANSWER - NA | CORRECT ANSWER - a,c | STATUS - SKIPPED

Solution :

(a, c)
- (a) and (c) are decidable.
- L_2 is undecidable because completeness problem of CFG is undecidable.

QUESTION ANALYTICS +

Q. 33

FAQ | Have any Doubt ?

Which of the below are undecidable?

A. $\{\langle M\rangle \mid M \text{ is a Turing Machine and M accepts } \in\}$. — Correct Option

B. $\{\langle G\rangle \mid G \text{ is a CFG and } G \text{ is unambiguous}\}$. — Correct Option

C. $\{\langle G, w\rangle\}$ G is a CFG, $w \in \Sigma^*$ and $w \in L(G)\}$

D. Given a CFG G, find whether $L(G) = R$, where R is regular set. — Correct Option

YOUR ANSWER - NA | CORRECT ANSWER - a,b,d | STATUS - SKIPPED

Solution :

(a, b, d)
- (a) is undecidable as this is non-trivial question on RE languages.
- (b) is ambiguous problem, well known undecidable.
- (c) is membership problem in CFG which is decidable.
- (d) is undecidable

QUESTION ANALYTICS +