Summary in Graph

Exam Summary (GO Classes CS Test Series 2025 | Theory of Computation | Subject Wise Test 1)

Qs. Attempted:	**0** 0 + 0	**Correct Marks:**	**0** 0 + 0
Correct Attempts:	**0** 0 + 0	**Penalty Marks:**	**0** 0 + 0
Incorrect Attempts:	**0** 0 + 0	**Resultant Marks:**	**0** 0 + 0

Total Questions:	**30** 10 + 20
Total Marks:	**50** 10 + 40
Exam Duration:	90 Minutes
Time Taken:	0 Minutes

EXAM RESPONSE | EXAM STATS | FEEDBACK

Technical

Q #1 | Multiple Select Type | Award: 1 | Penalty: 0 | Theory of Computation

A context-free grammar is *linear* if every rule is of the form $A \to u$ or $A \to uBv$ with $A, B \in V$ and $u, v \in \Sigma^*$. A language is linear if it is generated by a linear grammar.

Which of the following is/are true?

A. Every regular language is linear.
B. Every linear language is regular.
C. Every linear language is context-free.
D. Every context-free language is linear.

Your Answer: | **Correct Answer: A;C** | Not Attempted | Time taken: 00min 00sec | Discuss

Q #2 | Multiple Choice Type | Award: 1 | Penalty: 0.33 | Theory of Computation

A class of languages is closed under subsets if whenever L is in the class and $L' \subseteq L, L'$ is also in the class. Among the context-free, regular, and finite languages, the classes that are closed under subsets are:

A. none of context-free, regular, or finite.
B. all of context-free, regular, and finite.
C. only context-free

D. only finite.

Your Answer: | Correct Answer: D | Not Attempted | Time taken: 00min 02sec | Discuss

Q #3 | Multiple Choice Type | Award: 1 | Penalty: 0.33 | Theory of Computation

Context-free languages are closed under

A. union, star, and complementation but not intersection or concatenation.
B. union, star, and concatenation but not intersection or complementation.
C. union, star, intersection, and concatenation but not complementation.
D. union, star, intersection, concatenation, and complementation.

Your Answer: | Correct Answer: B | Not Attempted | Time taken: 00min 00sec | Discuss

Q #4 | Multiple Choice Type | Award: 1 | Penalty: 0.33 | Theory of Computation

If $\text{DFA M} = (Q, \Sigma, \delta, q_0, F)$ accepts input string $w \in \Sigma^\star$ with $|w| = n$, a computation of M on w

A. is a sequence of exactly n states
B. is a sequence of exactly $n + 1$ states
C. may be a sequence of any positive integer number of states
D. may be a sequence of any integer number of states that is at least n

Your Answer: | Correct Answer: B | Not Attempted | Time taken: 00min 00sec | Discuss

Q #5 | Multiple Select Type | Award: 1 | Penalty: 0 | Theory of Computation

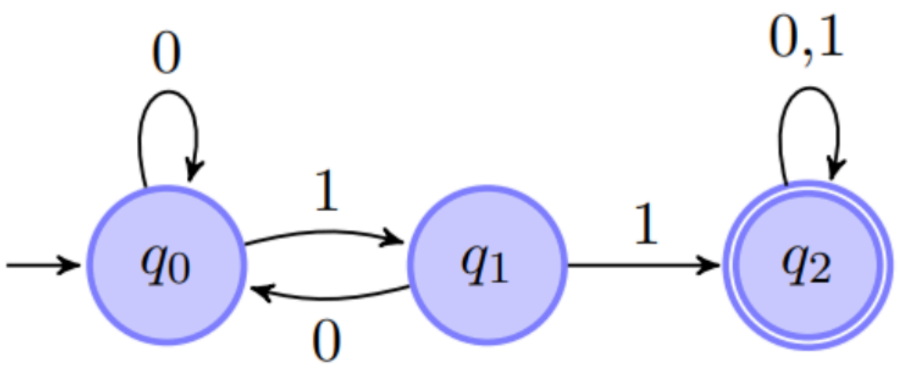
Which of the following is/are true?

A. Undecidable languages are closed under complement.
B. Decidable languages are not closed under complement.
C. CFLs are not closed under intersection with regular languages.
D. Regular languages are not closed under intersection with CFLs.

Your Answer: | Correct Answer: A;D | Not Attempted | Time taken: 00min 00sec | Discuss

Q #6 | Multiple Choice Type | Award: 1 | Penalty: 0.33 | Theory of Computation

Which of the following languages is recognized by the following finite automata?



A. Set of all binary strings ending with a "1".
B. Set of all binary strings containing substring 11 & ending with a "1".

C. Set of all binary strings containing substring 11.
D. None

Your Answer: | Correct Answer: C | Not Attempted | Time taken: 00min 00sec | Discuss

Q #7 | Multiple Choice Type | Award: 1 | Penalty: 0.33 | Theory of Computation

Let $\Sigma = \{\mathrm{a}, \mathrm{b}, \mathrm{c}\}$. Let

$$J = \{w \in \Sigma^* \mid \#_{\mathbf{a}}(w) = \#_{\mathbf{b}}(w) \text{ or } \#_{\mathbf{b}}(w) = \#_{\mathbf{c}}(w)\}$$

where $\#_z(w)$ is the number of appearances of the character z in string w. For example, the word $x = \mathrm{baccacbbcb} \in \mathrm{J}$, since $\#_{\mathrm{a}}(x) = 2, \#_{\mathrm{b}}(x) = 4$, and $\#_{\mathrm{c}}(x) = 4$. Similarly, the word $y = \mathrm{abbccc} \notin \mathrm{J}$, since $\#_{\mathrm{a}}(y) = 1, \#_{\mathrm{b}}(y) = 2$, and $\#_{\mathrm{c}}(y) = 3$.

Which of the following is true for J?

A. J is regular.
B. J is DCFL But not Regular.
C. J is CFL But not DCFL.
D. J is Not CFL.

Your Answer: | Correct Answer: C | Not Attempted | Time taken: 00min 00sec | Discuss

Q #8 | Multiple Select Type | Award: 1 | Penalty: 0 | Theory of Computation

Let DFA stand for deterministic finite automaton. Which of the following statements is/are true?

A. Some DFAs can recognize more than one language.
B. Every finite language is regular.
C. Every countable language is regular.
D. Some regular languages can be recognized by more than one DFAs.

Your Answer: | Correct Answer: B;D | Not Attempted | Time taken: 00min 00sec | Discuss

Q #9 | Multiple Choice Type | Award: 1 | Penalty: 0.33 | Theory of Computation

Which one of the following regular expressions generates the set of all strings not containing "baa" as a substring over input alphabet $\{a, b\}$?

A. $a^*(b^*a)^*$
B. a^*b^*ab
C. a^*baba^*
D. $a^*(ba + b)^*$

Your Answer: | Correct Answer: D | Not Attempted | Time taken: 00min 00sec | Discuss

Q #10 | Multiple Choice Type | Award: 1 | Penalty: 0.33 | Theory of Computation

If L is a language accepted by some automaton M, which of the following is(are) true?

I. If M is a non-deterministic finite automaton, then L is accepted by some deterministic finite automaton.
II. If M is a deterministic pushdown automaton, then L is accepted by some non-deterministic pushdown automaton.
III. If M is a non-deterministic pushdown automaton, then L is accepted by some deterministic Turing machine.

A. Only I
B. Only I and II
C. Only I and III
D. ALL

Your Answer: | Correct Answer: D | Not Attempted | Time taken: 00min 00sec | Discuss

Q #11 | Numerical Type | Award: 2 | Penalty: 0 | Theory of Computation

Let $\Sigma = \{\sigma_1, \ldots, \sigma_n\}$ be a finite alphabet, and suppose that the symbols have a total ordering $\sigma_1 \prec \sigma_2 \prec \cdots \prec \sigma_n$. We say that a string $w_1 \cdots w_m$ is sorted if $w_i \preceq w_{i+1}$ for all $1 \leq i < m$. Let L be the language containing all $\&$ only sorted strings. Note that the empty string is also a sorted string. If $n = 10$, the number of states in the minimal DFA accepting L is ________

Your Answer: | Correct Answer: 11 | Not Attempted | Time taken: 00min 00sec | Discuss

Q #12 | Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

The square of a language L is $\mathrm{Sq(L)} = \{ww : w \in \mathrm{L}\}$; the double of a language is $\mathrm{Do(L)} = \{wx : w, x \in \mathrm{L}\}$.
Which of the following is/are false?

A. If L is regular, $\mathrm{Do(L)}$ must be context-free.
B. If L is regular, $\mathrm{Sq(L)}$ must be context-free.
C. If L is $\mathrm{CFL}, \mathrm{Do(L)}$ must be context-free.
D. If L is $\mathrm{CFL}, \mathrm{Sq(L)}$ must be context-free.

Your Answer: | Correct Answer: B;D | Not Attempted | Time taken: 00min 00sec | Discuss

Q #13 | Multiple Choice Type | Award: 2 | Penalty: 0.67 | Theory of Computation

The pumping lemma for regular languages implies that
A. every regular language contains a string that can be pumped
B. all strings in a regular language can be written as uvw so that uv^iw is also in the language when $i \geq 0$
D. a regular language is infinite if and only if it contains a string that can be pumped
D. regular languages are closed under the regular operations

Your Answer: | Correct Answer: C | Not Attempted | Time taken: 00min 00sec | Discuss

Q #14 | Multiple Choice Type | Award: 2 | Penalty: 0.67 | Theory of Computation

The state elimination algorithm gives a way to transform a finite automaton (DFA or NFA) into a regular expression.
In this algorithm, when we delete(rip) a state from the given FA, we get a generalized NFA(GNFA) whose transitions are labeled with regular expressions instead of alphabet symbols.

To rip a state q_{rip} in the GNFA method, when there is a transition from q to q_{rip} labeled A, a transition from q_{rip} to q_{rip} labeled B, a transition from q_{rip} to q' labeled C, and a transition from q to q' labeled D, we make a transition from q to q' labeled

A. $(A(B)^{\star}C) \cup D$
B. $(ABC)^{\star} \cup D$
C. $ABCD$
D. $D \cup (AC)$

Your Answer: | Correct Answer: A | Not Attempted | Time taken: 00min 00sec | Discuss

Q #15 | Multiple Choice Type | Award: 2 | Penalty: 0.67 | Theory of Computation

$\{a^n b^m : n > m \geq 0\}$ is ______

A. not regular because $a^{p+1}b^p$ cannot be pumped
B. regular because it is a subset of $a^{\star}b^{\star}$
C. regular because it is described by a regular expression
D. not regular because $a^p b^p$ cannot be pumped

Your Answer: | Correct Answer: A | Not Attempted | Time taken: 00min 00sec | Discuss

Q #16 | Multiple Choice Type | Award: 2 | Penalty: 0.67 | Theory of Computation

For an NFA $\mathrm{M} = (Q, \Sigma, \delta, q_0, F)$ and a subset $S \subseteq Q$, which of the following is *not always true* about the ε closure $E(S)$?

A. Given M and S one can calculate $E(S)$ in finite time.
B. there is no ε transition from a state not in $E(S)$ to a state in $E(S)$
C. there is no ε transition from a state in $E(S)$ to a state not in $E(S)$
D. $E(S) = \cup_{q \in S} E(\{q\})$

Your Answer: | Correct Answer: B | Not Attempted | Time taken: 00min 00sec | Discuss

Q #17 | Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

DeMorgan's Laws ensure that

A. Closure under intersection and complementation imply closure under union.
B. Closure under intersection and union imply closure under complementation.
C. Closure under union and complementation imply closure under intersection.
D. Closure under any two of union, intersection, and complementation implies closure under all three.

Your Answer: | Correct Answer: A;C | Not Attempted | Time taken: 00min 00sec | Discuss

Q #18 | Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

Which of the following is/are true?

A. If A is a finite language, then A is regular.
B. If $\mathrm{A} \subseteq \mathrm{B} \subseteq \mathrm{C}$ with both A and C regular, then B is regular also.

C. If A is a subset of any regular language L, and A has all but only a finite number of strings from L, then A is regular.
D. The intersection of two CFLs, which both have unambiguous grammars, is a CFL.

Your Answer: | **Correct Answer: A;C** | Not Attempted | Time taken: 00min 00sec | Discuss

Q #19 | Multiple Choice Type | Award: 2 | Penalty: 0.67 | Theory of Computation

Let A be a regular language.

Let $M = (Q, \Sigma, \delta, q_0, F)$ be a DFA that recognizes A.

Construct $M' = (Q, \Sigma, \delta, q_0, F')$ where $F' = \{q \mid q \in Q$ and there is a path from q to a state in $F\}$

What is $\mathrm{L}\left(\mathrm{M}'\right)$?

A. $\text{Suffix}(A) = \{w \mid$ for some $x \in \Sigma^*, xw \in A\}$
B. $\text{Prefix}(A) = \{w \mid$ for some $x \in \Sigma^*, wx \in A\}$
C. Substring $(A) = \{w \mid$ for some $\mathrm{x}, \mathrm{y} \in \Sigma^*, \mathrm{xwy} \in \mathrm{A}\}$
D. Same as A

Your Answer: | **Correct Answer: B** | Not Attempted | Time taken: 00min 00sec | Discuss

Q #20 | Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

Which of the following is/are true?

A. L is accepted by some NFA with 374 states if and only if L is accepted by some DFA with 374 states.
B. If L is the union of two regular languages, then its complement $\overline{L}$ is context-free.
C. If L is the union of two undecidable languages, then L is undecidable.
D. If L is CFL then complement of L is not CFL.

Your Answer: | **Correct Answer: B** | Not Attempted | Time taken: 00min 00sec | Discuss

Q #21 | Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

Suppose we augment the DFA model by allowing each state to have one epsilon arrow. Call such an automaton an ϵ-DFA. Such an automaton computes as an NFA does, but formally the transition function is of the form $\delta : Q \times \Sigma_\epsilon \rightarrow Q$, rather than to $\mathcal{P}(\mathcal{Q})$ as in an NFA.

Which of the following is/are correct?

A. The language recognition power of ε-DFA is the same as that of DFA
B. The language recognition power of ε-DFA is the same as that of NFA.
C. The language recognition power of ε-DFA is more than DFA.
D. The language recognition power of ε-DFA is less than NFA.

Your Answer: | **Correct Answer: A;B** | Not Attempted | Time taken: 00min 00sec | Discuss

Q #22 | Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

Which of the following languages is/are Decidable?

A. $\mathrm{INFINITE_{TM}} = \{\langle \mathrm{M} \rangle | \mathrm{M}$ is a TM and $\mathrm{L(M)}$ is an infinite language $\}$
B. $\{\langle \mathrm{M} \rangle | \mathrm{M}$ is a TM and $1011 \in \mathrm{L(M)}\}$
C. $\mathrm{ALL}_{TM} = \{\langle \mathrm{M} \rangle \mid \mathrm{M}$ is a TM and $\mathrm{L(M)} = \Sigma^*\}$
D. $\mathrm{L} = \{\langle \mathrm{M} \rangle : | \mathrm{L(M)} | \geq 0\}$

Your Answer: | Correct Answer: D | Not Attempted | Time taken: 00min 00sec | Discuss

Q #23 | Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

If x is an integer, let $[x]_2$ denote its binary representation.

Consider the following languages over $\{0, 1\}$. Which of the following languages is/are Regular?

A. Let M be a Turing machine. The language $\{[n]_2 : \mathrm{M}$ accepts at least one string of length $\geq n\}$.
B. Let M be a PushDown Automata. The language $\{[n]_2 : \mathrm{M}$ accepts at least one string of length $\geq n\}$.
C. Let M be a Deterministic PushDown Automata. The language $\{[n]_2 : \mathrm{M}$ accepts at least one string of length $\geq n\}$.
D. Let M be a Finite Automata. The language $\{[n]_2 : \mathrm{M}$ accepts at least one string of length $\geq n\}$.

Your Answer: | Correct Answer: A;B;C;D | Not Attempted | Time taken: 00min 00sec | Discuss

Q #24 | Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

If x is an integer, let $[x]_2$ denote its binary representation.

Consider the following languages over $\{0, 1\}$.

Which of the following languages is/are Regular?

A. $\{[2^p]_2 : p$ is a prime number $\}$.
B. $\mathrm{L} = \{0^p : p$ is a prime $\}$.
C. L^* where $\mathrm{L} = \{0^p : p$ is a prime $\}$.
D. $\{[2^n]_2 : n \geq 0\}$.

Your Answer: | Correct Answer: C;D | Not Attempted | Time taken: 00min 00sec | Discuss

Q #25 | Multiple Choice Type | Award: 2 | Penalty: 0.67 | Theory of Computation

Let L be a Turing-recognizable language and let $\overline{L}$(the complement of L) be such that it is not Turing-recognizable. Consider the language:

$$\mathrm{L}' = \{0w \mid w \in L\} \cup \{1w \mid w \notin L\}$$

Which is correct?

A. L' is Turing-decidable But not regular.
B. L' is Turing-recognizable But not Turing-decidable.
C. L' is not even Turing-recognizable.
D. L' is Regular.

Your Answer: | Correct Answer: C | Not Attempted | Time taken: 00min 00sec | Discuss

Q #26 | Numerical Type | Award: 2 | Penalty: 0 | Theory of Computation

Define the size of a context-free grammar to be the total number of characters used in writing the rules of the grammar down (including nonterminals, terminals, $|$ and $\rightarrow$). For example, the one-line grammar $\mathrm{A} \rightarrow \mathrm{A1} \mid \epsilon$ has size six since it uses six characters. Consider a grammar that generates only the string "**manamana banana**" and no other strings. Here the set of terminals is the set of small letters in the English alphabet and the whitespace character (denoted explicitly by $\sqcup$), i.e. it is the set $\{a, b, c, \ldots z, \sqcup\}$. The smallest CFG that generates only this string has size ___ ?

Your Answer: | **Correct Answer: 16** | Not Attempted | Time taken: 00min 00sec | Discuss

Q #27 | Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

Which of the following statements is/are true?

A. If L_1 is context free and L_2 is not context free, then $\mathrm{L}_1 \cdot \mathrm{L}_2$ is not context-free.
B. If L_1 is context free and L_2 is not context free, then $\mathrm{L}_1 \cdot \mathrm{L}_2$ is context-free.
C. If L_1 and L_2 are context free, then $\mathrm{L}_1 \cap \mathrm{L}_2$ is not context-free.
D. If L is not context-free, then it is not regular.

Your Answer: | **Correct Answer: D** | Not Attempted | Time taken: 00min 00sec | Discuss

Q #28 | Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

Which of the following statements is/are true?

A. Let $\Sigma = \{a, b\}$ and $\mathrm{L} = \{a^n w a^n \mid n \geq 1, w \in \Sigma^*\}$. L is not regular but is context-free.
B. A non-deterministic TM can decide languages that a regular TM cannot decide.
C. If a language L is context-free then $\overline{\mathrm{L}}$ is TM decidable.
D. The language $L = \{\langle \mathrm{M}, w \rangle \mid$ TM M does not accept string $w\}$ is TM recognizable.

Your Answer: | **Correct Answer: C** | Not Attempted | Time taken: 00min 00sec | Discuss

Q #29 | Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

Which of the following languages is/are Regular?

A. $\mathrm{L} = \{xw \mid x, w \in \{\mathrm{a}, \mathrm{b}\}^*$ and $|x| = |w|\}$
B. $\mathrm{L} = \left\{\mathrm{a}^i\ \mathrm{b}^j \mathrm{c}^k\ \mathrm{d}^m \mid i + j + k + m\right.$ is a multiple of $13\}$
C. $\mathrm{L} = \{w\#w \mid w \in \{0, 1\}^*\}$
D. $\mathrm{L} = \{a^n b^n w \mid n \geq 0, w \in \{c, d\}^*, \mid w \mid = n\}$

Your Answer: | **Correct Answer: A;B** | Not Attempted | Time taken: 00min 00sec | Discuss

Q #30 | Numerical Type | Award: 2 | Penalty: 0 | Theory of Computation

Let N be some NFA (Non-Deterministic Finite Automata) with 9 states and let the cardinality of the input alphabet set be 3. If the language accepted by N i.e., $\mathrm{L}(\mathrm{N})$ is finite, the maximum value of $|\mathrm{L}(\mathrm{N})|$ will be? Where $|\mathrm{L}(\mathrm{N})|$ denotes the cardinality of $\mathrm{L}(\mathrm{N})$.

Your Answer: **Correct Answer: 9841** Not Attempted Time taken: 00min 00sec Discuss