Summary in Graph

Exam Summary (GO Classes Test Series 2024 | Theory of Computation | Test 5)

Qs. Attempted:	**10** 5 + 5	**Correct Marks:**	**0** 0 + 0
Correct Attempts:	**0** 0 + 0	**Penalty Marks:**	**1.67** 1 + 0.67
Incorrect Attempts:	**10** 5 + 5	**Resultant Marks:**	**-1.66** -0.99 + -0.66

Total Questions:	**15** 5 + 10
Total Marks:	**25** 5 + 20
Exam Duration:	**45 Minutes**
Time Taken:	**45 Minutes**

EXAM RESPONSE | EXAM STATS | FEEDBACK

Technical

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

Which of the following languages are undecidable?

A. $\mathrm{A}_1 = \{\langle \mathrm{M} \rangle \mid \mathrm{M} \text{ is a Turing Machine that has an even number of states } \}$
B. $\mathrm{A}_2 = \{\langle \mathrm{M}_1, \mathrm{M}_2 \rangle \mid \mathrm{M}_1, \mathrm{M}_2 \text{ are Turing Machines and } \mathrm{L}(\mathrm{M}_1) \cup \mathrm{L}(\mathrm{M}_2) = \Sigma^* \}$
C. $\mathrm{A}_3 = \{\langle \mathrm{M} \rangle \mid M \text{ is a Turing Machine and } \mathrm{L}(\mathrm{M}) \text{ is finite } \}$
D. $\mathrm{A}_4 = \{\langle \mathrm{M} \rangle \mid \mathrm{M} \text{ is an DFA } \mathrm{L}(\mathrm{M}) \text{ is finite } \}$

Your Answer: C | Correct Answer: B;C | Incorrect | Discuss

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

A context-free language L is given in the form of a context-free grammar G.
Consider the following decision problems:

- $\mathrm{P1}$: Is there a push-down automaton P which recognizes L with bounded stack usage, i.e., there is a constant bound $k \in \mathbb{N}$ such that no run of P needs more than k symbols on the stack.
- $\mathrm{P2}$: Is L regular?

Which of the above decision problems are undecidable?

A. Only $\mathrm{P1}$
B. Only $\mathrm{P2}$
C. Both
D. None

Your Answer: A **Correct Answer: C** Incorrect Discuss

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

Consider the following statements :

1. Let L be a language accepted by a non-deterministic Turing machine in which every computation terminates. Then L is recursive.
2. A language L is recursive if, and only if, L and L' are recursively enumerable.

Which of the above statements is/are true?

A. Only 1
B. Only 2
C. Both
D. None

Your Answer: A **Correct Answer: C** Incorrect Discuss

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

Consider the following languages :

- $\mathrm{L1} := \{\langle \mathrm{M} \rangle \mid \mathrm{M} \text{ is a } \mathrm{TM} \text{ and } \mathrm{L(M)} \text{ is countable } \}$.
- $\mathrm{L2} := \{\langle \mathrm{M} \rangle \mid \mathrm{M} \text{ is a } \mathrm{TM} \text{ and } \mathrm{L(M)} \text{ is uncountable } \}$.

Which of the above languages is Decidable?

A. Only $\mathrm{L1}$
B. Only $\mathrm{L2}$
C. Both
D. None

Your Answer: D **Correct Answer: C** Incorrect Discuss

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

Which of the following is/are non-trivial properties for the set of RE languages?

A. L is a countable language.
B. L is a context-free language.
C. L is a decidable language.
D. L is a Turing recognizable language.

Your Answer: A;D **Correct Answer: B;C** Incorrect Discuss

Q #6 Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

Which of the following is/are true?

A. Every infinite context free language L has a subset S which is undecidable.
B. Every infinite context free language L has a subset S which is unrecognizable.
C. Every infinite context free language L has an infinite subset S which is non-regular.
D. Every infinite context free language L has an infinite subset S which is regular.

Your Answer: | **Correct Answer: A;B;C** | Not Attempted | Discuss

Q #7 Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

Which of the following statements are true?

A. If every subset of a language L is CFL, then L must be CFL.
B. If every subset of a language L is CFL, then L must be regular.
C. If every subset of a language L is decidable, then L must be decidable.
D. If every subset of a language L is decidable, then L must be finite.

Your Answer: A;C | **Correct Answer: A;B;C;D** | Incorrect | Discuss

Q #8 Multiple Choice Type | Award: 2 | Penalty: 0.67 | Theory of Computation

Let M be the Turing machine defined by

δ	B	a	b	c
q_0	$q_1, \mathrm{B}, \mathrm{R}$			
q_1	$q_2, \mathrm{B}, \mathrm{L}$	q_1, a, R	q_1, c, R	q_1, c, R
q_2		q_2, c, L		q_2, b, L

q_0 is the starting state. B is the blank tape symbol. Describe the result of a computation in M.

A. The result of a computation is to replace the a's in the input string with b's and the c's with b's.
B. The result of a computation is to replace the a's in the input string with c's and the c's with a's.
C. The result of a computation is to replace the a's in the input string with c's and the c's with b's.
D. The result of a computation is to replace the a's in the input string with b's and the c's with a's.

Your Answer: B | **Correct Answer: C** | Incorrect | Discuss

Q #9 Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

Let set S have an infinite number of elements, and set A have a finite number of elements then which of the following statements is/are False?

A. If f is a one-one mapping from set S to set S, then f is onto.
B. If f is an onto mapping from set S to set S, then f is one-one.
C. If f is a one-one mapping from set A to set A, then f is onto.
D. If f is an onto mapping from set A to set A, then f is one-one.

Your Answer: A;B;C;D | **Correct Answer: A;B** | Incorrect | Discuss

Q #10 Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

For an automata M, let $\langle \mathrm{M} \rangle$ denote some unary encoding of M, and $\mathrm{L}(\mathrm{M})$ denotes the set of strings, over $\{0, 1\}$, accepted by M.
Which of the following languages are Turing-recognizable?

A. $\{\langle \mathrm{M} \rangle | \mathrm{M}$ is a (deterministic) Turing machine and M accepts $010\}$.
B. $\{\langle \mathrm{M} \rangle | \mathrm{M}$ is a nondeterministic Turing machine and M accepts $010\}$.
C. $\{\langle \mathrm{M} \rangle | \mathrm{M}$ is a Turing machine and M does not accept $101\}$.
D. $\{\langle \mathrm{M} \rangle \mid \mathrm{M}$ is a Turing machine and $\mathrm{L}(\mathrm{M}) = \Sigma^*\}$.

Your Answer: | **Correct Answer: A;B** | Not Attempted | Discuss

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

If A is a set, let $|\mathrm{A}|$ denotes the cardinality of set A. We say $|\mathrm{B}| \leq |\mathrm{A}|$ if and only if there exists an injection from B to A. We say $|\mathrm{B}| < |\mathrm{A}|$ if and only if there exists an injection from B to A but there is no surjection from B to A.

Which of the following is/are false?

A. Let A be an uncountable set. There is no uncountable set B with $|\mathrm{B}| < |\mathrm{A}|$.
B. Let A be a countable set. There is no infinite set B with $|\mathrm{B}| < |\mathrm{A}|$.
C. Every subset of an uncountable set is either finite or countably infinite.
D. Let L be some Non-recursive enumerable language, then L is countable.

Your Answer: | **Correct Answer: A;C** | Not Attempted | Discuss

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

Suppose there are four problems (languages) A, B, C, and D. Each of these languages may or may not be recursively enumerable. However, we know the following about them:

i. There is a mapping reduction (i.e., an algorithm which can be carried out by some Turing machine, not necessarily polynomial-time) from A to B.
ii. There is a mapping reduction from B to C.
iii. There is a mapping reduction from D to C

Consider the following statements and select the statements that are CERTAIN to be true, regardless of what problems A through D are.

A. If A is recursive, then the complement of B is recursive.
B. If C is recursive, then the complement of D is recursive.
C. If C is recursively enumerable, then the union of B and D is recursively enumerable.
D. If C is recursively enumerable, then the intersection of B and D is recursively enumerable.

Your Answer: C;D | **Correct Answer: B;C;D** | Incorrect | Discuss

Q #13 Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

For a Turing machine M, let $\langle \mathrm{M} \rangle$ denote some binary encoding of M, and $\mathrm{L}(\mathrm{M})$ denotes the set of strings, over $\{0, 1\}$, accepted by M.
Which of the following languages is/are undecidable :

A. $\mathrm{L1} := \{\langle \mathrm{M} \rangle \mid \mathrm{M}$ is a TM and there exists an input on which M halts in less than $|\langle \mathrm{M} \rangle|$ steps .
B. $\mathrm{L2} := \{\langle \mathrm{M} \rangle \mid \mathrm{M}$ is a TM and $|\mathrm{L}(\mathrm{M})| \leq 3\}$.
C. $\mathrm{L3} := \{\langle \mathrm{M} \rangle \mid \mathrm{M}$ is a TM that accepts all even numbers $\}$.
D. $\mathrm{L4} := \{\langle \mathrm{M} \rangle \mid \mathrm{M}$ is a TM and $|\mathrm{L}(\mathrm{M})| \geq 3\}$.

Your Answer: | **Correct Answer: B;C;D** | Not Attempted | Discuss

Q #14 | Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

Consider the following problems. $\mathrm{L}(\mathrm{G})$ denotes the language generated by a grammar G. $\mathrm{L}(\mathrm{M})$ denotes the language accepted by a machine M.

Which one of the following problems is/are decidable?

A. For an unrestricted grammar G and a string w, where $w \in \mathrm{L}(\mathrm{G})$.
B. Given a Turing Machine M, whether $\mathrm{L}(\mathrm{M})$ is regular.
C. Given two grammars G_1 and G_2 whether $\mathrm{L}\left(\mathrm{G}_1\right) = \mathrm{L}\left(\mathrm{G}_2\right)$.
D. Given an NFA N, whether there is a deterministic PDA P such that N and P accept the same language.

Your Answer: | **Correct Answer: D** | Not Attempted | Discuss

Q #15 | Multiple Select Type | Award: 2 | Penalty: 0 | Theory of Computation

Which of the following statements are true?

A. If A is a subset of B and A is uncountable, then so is B.
B. If A is uncountable and B is any set, then the union $\mathrm{A} \cup \mathrm{B}$ is also uncountable.
C. If A is uncountable and B is any set, then the Cartesian product $\mathrm{A} \times \mathrm{B}$ is also uncountable.
D. If A is infinite (even countably infinite) then the power set of A is uncountable.

Your Answer: A;B;C;D | **Correct Answer: A;B;D** | Incorrect | Discuss