

**NADAR SARASWATHI COLLEGE OF ENGINEERING AND TECHNOLOGY, THENI.**

<b>Course/Branch</b> : B.E / CSE	<b>Year / Semester</b> : III / V	Format No.	NAC/TLP-07a.13
<b>Subject Code</b> : CS8501	<b>Subject Name</b> : Theory of Computation	Rev. No.	02
<b>Unit No</b> : V	<b>Unit Name</b> : Undecidability	Date	8.10.2020

**OBJECTIVE TYPE QUESTION BANK**

<b>S. No.</b>	<b>Objective Questions (MCQ /True or False / Fill up with Choices )</b>	<b>BTL</b>
1	Which of the following are decidable? I. Whether the intersection of two regular languages is infinite II. Whether a given context-free language is regular III. Whether two push-down automata accept the same language IV. Whether a given grammar is context-free A) I and II <b>B) I and IV</b> C) II and III D) II and IV	L2
2	Which of the following problems is undecidable? A) Membership problem for CFGs <b>B) Ambiguity problem for CFGs</b> C) Finiteness problem for FSAs D) Equivalence problem for FSAs	L2
3	Let $\langle M \rangle$ be the encoding of a Turing machine as a string over $\{0, 1\}$ . Let $L = \{ \langle M \rangle \mid M \text{ is a Turing machine that accepts a string of length } 2014 \}$ . Then, L is A) decidable and recursively enumerable <b>B) undecidable but recursively enumerable</b> C) undecidable and not recursively enumerable D) decidable but not recursively enumerable	L2
4	Which of the following problems is undecidable? <b>A) Deciding if a given context-free grammar is ambiguous</b> B) Deciding if a given string is generated by a given context-free grammar C) Deciding if the language generated by a given context-free grammar is empty D) Deciding if the language generated by a given context-free grammar is finite	L2
5	Consider three decision problems P1, P2 and P3. It is known that P1 is decidable and P2 is undecidable. Which one of the following is TRUE? A) P3 is decidable if P1 is reducible to P3 B) P3 is undecidable if P3 is reducible to P2 <b>C) P3 is undecidable if P2 is reducible to P3</b> D) P3 is decidable if P3 is reducible to P2's complement	L2
6	Consider the following statements: 1. The complement of every Turing decidable language is Turing decidable 2. There exists some language which is in NP but is not Turing decidable 3. If L is a language in NP, L is Turing decidable Which of the above statements is/are True? A) Only 2 B) Only 3 C) Only 1 and 2 <b>D) Only 1 and 3</b>	L2

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7	<p>Which of the following decision problems are undecidable?</p> <p>I. Given NFAs <math>N_1</math> and <math>N_2</math>, is <math>L(N_1) \cap L(N_2) = \Phi</math>?</p> <p>II. Given a CFG <math>G = (N, \Sigma, P, S)</math> and a string <math>x \in \Sigma^*</math>, does <math>x \in L(G)</math>?</p> <p>III. Given CFGs <math>G_1</math> and <math>G_2</math>, is <math>L(G_1) = L(G_2)</math>?</p> <p>IV. Given a TM <math>M</math>, is <math>L(M) = \Phi</math>?</p> <p>A) I and IV only                  B) II and III only  <b>C) III and IV only</b>                  D) II and IV only</p>	L2
8	<p>Which of the following problems are decidable?</p> <p>1) Does a given program ever produce an output?                  2) If L is a context-free language, then is <math>L'</math> (complement of L) also context-free?                  3) If L is a regular language, then is <math>L'</math> also regular?                  4) If L is a recursive language, then, is <math>L'</math> also recursive?</p> <p>A) 1, 2, 3, 4                  B) 1,2                  C) 2,3,4  <b>D) 3,4</b></p>	L2
9	<p>Let S and T be language over <math>\Sigma = \{a,b\}</math> represented by the regular expressions <math>(a+b^*)^*</math> and <math>(a+b)^*</math>, respectively. Which of the following is true?</p> <p>A) <math>S \subset T</math> (S is a subset of T)                  B) <math>T \subset S</math> (T is a subset of S)  <b>C) <math>S=T</math></b>                  D) <math>S \cap T = \emptyset</math></p>	L2
10	<p>Consider the language <math>L_1, L_2, L_3</math> as given below.</p> <p><math>L_1 = \{0^p 1^q \mid p, q \in \mathbb{N}\}</math>  <math>L_2 = \{0^p 1^q \mid p, q \in \mathbb{N} \text{ and } p=q\}</math>  <math>L_3 = \{0^p 1^q 0^r \mid p, q, r \in \mathbb{N} \text{ and } p=q=r\}</math></p> <p>Which of the following statements is NOT TRUE?</p> <p>A) Push Down Automata (PDA) can be used to recognize <math>L_1</math> and <math>L_2</math>                  B) <math>L_1</math> is a regular language  <b>C) All the three languages are context free</b>                  D) Turing machine can be used to recognize all the three languages</p>	L2
11	<p>If L and <math>L'</math> are recursively enumerable, then L is</p> <p>A) regular                  B) context-free                  C) context-sensitive  <b>D) recursive</b></p>	L2

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12	Let L be a language and L' be its complement. Which one of the following is NOT a viable possibility? A) Neither L nor L' is recursively enumerable (r.e.) B) One of L and L' is r.e. but not recursive; the other is not r.e. <b>C) Both L and L' are r.e. but not recursive</b> D) Both L and L' are recursive	L2
13	Let $A \leq_m B$ denotes that language A is mapping reducible (also known as many-to-one reducible) to language B. Which one of the following is FALSE? A) If $A \leq_m B$ and B is recursive then A is recursive B) If $A \leq_m B$ and A is undecidable then B is undecidable C) If $A \leq_m B$ and B is recursively enumerable then A is recursively enumerable <b>D) If <math>A \leq_m B</math> and B is not recursively enumerable then A is not recursively enumerable</b>	L2
14	For $S \in (0 + 1)^*$ let $d(s)$ denote the decimal value of s (e.g. $d(101) = 5$ ). Let $L = \{s \in (0 + 1)^* \mid d(s) \bmod 5 = 2 \text{ and } d(s) \bmod 7! = 4\}$ . Which one of the following statements is true? A) L is recursively enumerable, but not recursive B) L is recursive, but not context-free C) L is context-free, but not regular <b>D) L is regular</b>	L2
15	Let L1 be a recursive language, and let L2 be a recursively enumerable but not a recursive language. Which one of the following is TRUE? L1' --> Complement of L1 L2' --> Complement of L2 A) L1' is recursive and L2' is recursively enumerable <b>B) L1' is recursive and L2' is not recursively enumerable</b> C) L1' and L2' are recursively enumerable D) L1' is recursively enumerable and L2' is recursive	L2
16	For any two languages L1 and L2 such that L1 is context free and L2 is recursively enumerable but not recursive, which of the following is/are necessarily true? 1. L1' (complement of L1) is recursive 2. L2' (complement of L2) is recursive 3. L1' is context-free 4. $L1' \cup L2$ is recursively enumerable A) 1 only B) 3 only C) 3 and 4 only <b>D) 1 and 4 only</b>	L2

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17	<p>Let X be a recursive language and Y be a recursively enumerable but not recursive language. Let W and Z be two languages such that Y' reduces to W, and Z reduces to X' (reduction means the standard many-one reduction).</p> <p>Which one of the following statements is TRUE ?</p> <p>A) W can be recursively enumerable and Z is recursive          B) W can be recursive and Z is recursively enumerable  <b>C) W is not recursively enumerable and Z is recursive</b>          D) W is not recursively enumerable and Z is not recursive</p>	L2
18	<p>Consider the following types of languages:</p> <p>L1 Regular,          L2: Context-free,          L3: Recursive,          L4: Recursively enumerable.</p> <p>Which of the following is/are TRUE?</p> <p>I. <math>L3' \cup L4</math> is recursively enumerable          II. <math>L2 \cup L3</math> is recursive          III. <math>L1^* \cup L2</math> is context-free          IV. <math>L1 \cup L2'</math> is context-free</p> <p>A) I only          B) I and III only          C) I and IV only  <b>D) I, II and III only</b></p>	L2
19	<p>Consider the following two statements:</p> <p>S1: <math>\{0^{2n} \mid n \geq 1\}</math> is a regular language          S2: <math>\{0^m 0^n 0^{(m+n)} \mid m \geq 1 \text{ and } n \geq 2\}</math> is a regular language</p> <p>Which of the following statements is correct?</p> <p>A) Only S1 is correct          B) Only S2 is correct  <b>C) Both S1 and S2 are correct</b>          D) None of S1 and S2 is correct</p>	L2
20	<p>According to the Rice's theorem, If P is a non-trivial property, <math>L_p</math> is</p> <p>A) infinite          B) decidable  <b>C) undecidable</b>          D) Not mentioned</p>	L2
21	<p>Can a Modified PCP problem be reduced to PCP?</p> <p><b>A) yes</b>          B) no</p>	L1

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22	Consider three decision problem A, B, C. A is decidable and B is not. Which of the following is a correct option? A) C is undecidable if C is reducible to B <b>B) C is undecidable if B is reducible to C</b> C) C is decidable if A is reducible to C D) C is decidable if C is reducible to B's complement.	L1
23	The hardest of NP problems can be: <b>A) NP-complete</b> B) NP-hard C) P D) None of the mentioned	L1
24	The set of all recursively enumerable languages is A) closed under complementation <b>B) closed under intersection</b> C) a subset of the set of all recursive languages. D) an uncountable set.	L1
25	Assuming $P \neq NP$ , which of the following is <b>TRUE</b> ? A) $NP\text{-complete} = NP$ <b>B) <math>NP\text{-complete} \cap P = \phi</math></b> C) $NP\text{-hard} = NP$ D) $P = NP\text{-complete}$	L1
26	Which among the following are undecidable theories? A) The first order theory of Boolean algebra B) The first order theory of Euclidean geometry C) The first order theory of hyperbolic geometry <b>D) The first order theory of the natural number with addition, multiplication, and equality</b>	L2
26	The language accepted by a turing machine is called _____ A) Recursive Ennumerable B) Recursive <b>C) Both (a) and (b)</b> D) None of the mentioned	L2
27	The problems which have no algorithm, regardless of whether or not they are accepted by a turing machine that fails to halts on some input are referred as: A) Decidable <b>B) Undecidable</b> C) Computable D) None of the mentioned	L2
28	An algorithm is called efficient if it runs in _____ time on a serial computer. <b>A) polynomial</b> B) non polynomial C) logarithmic D) none of the mentioned	L2

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29	A problem is called _____ if its has an efficient algorithm for itself. <b>A) tractable</b> B) intractable C) computational D) none of the mentioned	L2
30	Recursive languages are also known as: <b>A) decidable</b> B) undecidable C) sometimes decidable D) none of the mentioned	L2
31	According to the rice's theorem, If P is a non trivial property, Lp is : A) infinite B) decidable <b>C) undecidable</b> D) none of the mentioned	L1
32	Which of the following is incorrect according to rice theorem? Let S be a set of language hat is non trivial: A) there exists a TM that recognizes the language in S B) there exists a TM that recognizes the language not in S <b>C) both (a) and (b)</b> D) none of the mentioned	L2
33	Post Correspondence problem is A) decidable decision problem <b>B) undecidable decision problem</b> C) not a decision problem D) none of the mentioned	L1
34	Consider three decision problem A, B, C. A is decidable and B is not. Which of the following is a correct option? A) C is undecidable if C is reducible to B <b>B) C is undecidable if B is reducible to C</b> C) C is decidable if A is reducible to C D) C is decidable if C is reducible to B's complement.	L2
35	If the number of steps required to solve a problem is $O(n^k)$ , then the problem is said to be solved in: A) non-polynomial time <b>B) polynomial time</b> C) infinite time D) none of the mentioned	L2
36	Which of the following cannot be solved using polynomial time? A) Linear Programming B) Greatest common divisor C) Maximum matching <b>D) None of the mentioned</b>	L2

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37	The complexity class P consist of all the decision problems that can be solved by _____ using polynomial amount of computation time. A) Push Down automata B) DFA C) NDFA <b>D) Deterministic Turing machine</b>	L2
38	What does NP stands for in complexity classes theory? A) Non polynomial <b>B) Non-deterministic polynomial</b> C) Both (a) and (b) D) None of the mentioned	L2
39	Travelling sales man problem belongs to which of the class? A) P <b>B) NP</b> C) Linear D) None of the mentioned	L2
40	A problem which is both _____ and _____ is said to be NP complete. <b>A) NP, P</b> B) NP, NP hard C) P, P complete D) None of the mentioned	L2
41	Which of the following can be used to define NP complexity class? A) Verifier B) Polynomial time <b>C) Both (a) and (b)</b> D) None of the mentioned	L2
42	Which of the following does not belong to the closure properties of NP class? A) Union B) Concatenation C) Reversal <b>D) Complement</b>	L2
43	Fill in the blank with reference to Rice's theorem. For any non-trivial property of _____ no general or effective method can decide whether an algorithm computes it with that property. <b>A) partial functions</b> B) piecewise functions C) both (a) and (b) D) none of the mentioned	L2