TOC Unit 6 MCQ QB

Unit VI Undecidability & Intractable Problems

MCQs Question Bank

1. The class of recursively enumerable language is known as:
A. Turing Class
B. Recursive Languages
C. Universal Languages
D. RE
   Answer: D
Explanation: RE or recursively enumerable is only called the class of recursively enumerable language.

2. If L and L' are recursively enumerable, then L is
   A. regular
   B. context-free
   C. context-sensitive
   D. recursive
   Answer: D
   Explanation: If L and L' are recursively enumerable, then L is recursive

3. A language L is said to be Turing decidable if:
A. recursive
B. TM recognizes L
C. TM accepts L
D. Both A & B
   Answer: D
Explanation: A language L is recursively enumerable if there is a turing machine that accepts L, and recursive if there is a TM that recognizes L.(Sometimes these languages are called Turing-acceptable and Turing-decidable respectively).

4. Which of the following statements are false?
A. Every recursive language is recursively enumerable
B. Recursively enumerable language may not be recursive
C. Recursive languages may not be recursively enumerable
D. None of the mentioned
   Answer: C

  Explanation: Every recursive language is recursively enumerable but there exists recursively enumerable languages that are not recursive. If L is accepted by a Non deterministic TM T, and every possible sequence of moves of T causes it to halt, then L is recursive.

5. Choose the correct option:
Statement: If L1 and L2 are recursively enumerable languages over S, then the following is/are recursively enumerable.
A. L1 U L2
B. L2 ∩ L2
C. Both (a) and (b)
D. None of the mentioned
    Answer: C
 Explanation: Both the union and intersection operations preserve the property of recursive enumerable (Theorem).

6. If L is a recursive language, L' is:
A. Recursive
B. Recursively Enumerable
C. Both (a) and (b)
D. None of the mentioned
    Answer: C
 Explanation: :If T is a turing machine recognizing L, we can make it recognize L' by interchanging the two outputs. And every recursive language is recursively ennumerable.

7. Choose the appropriate option:
Statement: If a language L is recursive, it is closed under the following operations: A. Union
B. Intersection
C. Complement
D. All of the mentioned
    Answer: D
 Explanation: The closure property of recursive languages include union, intersection and complement operations.

8. A recursively enumerable language L can be recursive if:
A. L' is recursively enumerable
B. Every possible sequence of moves of T, the TM which accept L, causes it to halt C. Both (a) and (b)
D. None of the mentioned
    Answer: C
 Explanation: Theorem- If L is a recursively enumerable language whose complement is recursively enumerable, then L is recursive.

9. A Language L may not be accepted by a Turing Machine if:
A. It it is recursively enumerable
B. It is recursive

C. L can be enumerated by some turing machine
D. None of the mentioned
    Answer: B
 Explanation: A language L is recursively enumerable if and only if it can be enumerated by some turing machine. A recursive enumerable language may or may not be recursive.

10. Which of the following problems is undecidable?
A. Membership problem for CFGs
B. Ambiguity problem for CFGs
C. Finiteness problem for Finite State Automata
D. Equivalence problem for Finite State Automata
    Answer: B
 Explanation: Deciding whether grammar is Ambiguous grammar or not is an undecidable problem.

11. Post Correspondence problem is
A. decidable decision problem
B. undecidable decision problem
C. not a decision problem
D. none of the mentioned
Answer: B
Explanation: Post Correspondence problem is an undecidable decision problem that was introduced by Emil Post in 1946. Being simpler than halting problem, it can be used in proofs of undecidability.

12. PCP stands for?
A. Post Correspondence Problem
B. Post Corresponding Problem
C. Pre Correspondence problem
D. None of the mentioned
Answer: A
Explanation: PCP or Post Correspondence problem is an undecidable decision problem.

13. 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. C is undecidable if B is reducible to C

C. C is decidable if A is reducible to C

D. C is decidable if C is reducible to B's complement.

Answer: B
Explanation: As B is undecidable and it can be reduced to C, C is also an undecidable

problem.

14. The worst-case efficiency of solving a problem in polynomial
time is? A. O(p(n))
B. O(p(n log n))
C. O(p(n^2))
D. O(p(m log n))
Answer: A
Explanation: The worst-case efficiency of solving an problem in polynomial time is
O(p(n)) where p(n) is the polynomial time of input size.

15. Problems that can be solved in polynomial time are known as?
A. intractable
B. tractable
C. decision
D. complete
Answer: B
Explanation: Problems that can be solved in polynomial time are known as tractable.
Problems that cannot be solved in polynomial time are intractable.

16. _____ is the class of decision problems that can be solved by
non-deterministic polynomial algorithms?
A. NP
B. P
C. Hard
D. Complete
Answer: A
Explanation: NP problems are called as non-deterministic polynomial problems. They
are a class of decision problems that can be solved using NP algorithms.

17. Problems that cannot be solved by any algorithm are called?
A. tractable problems
B. intractable problems
C. undecidable problems
D. decidable problems
Answer: C
Explanation: Problems cannot be solved by any algorithm are called undecidable
problems. Problems that can be solved in polynomial time are called Tractable
problems.

18. Halting problem is an example for?
A. decidable problem
B. undecidable problem

C. complete problem
D. tractable problem
Answer: B
Explanation: Halting problem by Alan Turing cannot be solved by any algorithm.
Hence, it is undecidable.

19. To which of the following class does a satisfiability problem belong?
A. NP class
B. P class
C. NP complete
D. NP hard
Answer: C
Explanation: The satisfiability problem belongs to NP complete class. It deals with
Boolean expressions.

20. Which of the following problems is not NP complete?
A. Hamiltonian circuit
B. Bin packing
C. Partition problem
D. Halting problem
Answer: D
Explanation: Hamiltonian circuit, bin packing, partition problems are NP complete
problems. Halting problem is an undecidable problem.

21. The choice of polynomial class has led to the development of an extensive
theory called _____
A. computational complexity
B. time complexity
C. problem complexity
D. decision complexity
Answer: A
Explanation: An extensive theory called computational complexity seeks to classify
problems according to their inherent difficulty.

22. What does NP stands for in complexity classes theory?
A. Non polynomial
B. Non-deterministic polynomial
C. Both (a) and (b)
D. None of the mentioned
Answer: B
Explanation: NP is said to be one of the most fundamental complexity classes. NP is an
acronym for Non deterministic polynomial time.

23. The hardest of NP problems can be:
A. NP-complete

B. NP-hard

C. P

D. None of the mentioned

Answer: A

Explanation: NP class contains many important problems, the hardest of which is NP-complete, whose solution is sufficient to deal with any other NP problem in polynomial time.

24. Traveling sales man problem belongs to which of the class?

A. P

B. NP

C. Linear

D. None of the mentioned

Answer: B

Explanation: Traveling Salesman Problem: Given an input matrix of distances between n cities, this problem is to determine if there is a route visiting all cities with total distance less than k.

25. State true or false?

Statement: If a problem X is in NP and a polynomial time algorithm for X could also be used to solve problem Y in polynomial time, then Y is also in NP.

A. true

B. false

Answer: A

Explanation: This is just a commutative property of NP complexity class where a problem is said to be in NP if it can be solved using an algorithm which was used to solve another NP problem in polynomial amount of time.

26. A problem which is both _____ and _____ is said to be NP

complete. A. NP, P

B. NP, NP hard

C. P, P complete

D. None of the mentioned

Answer : A

Explanation: A problem is said to be NP Hard if an algorithm for solving the problem can be translated from for solving any other problem. It is easier to show a problem NP than showing it Np Hard.

27. Which of the following does not belong to the closure properties of

NP class? A. Union

B. Concatenation

C. Reversal

D. Complement

Answer: D

Explanation: It is unknown about the closure property-complement for the complexity

class NP. The question is so called NP versus co-NP problem.

28. Kruskal's algorithm is used to _____
A. find minimum spanning tree
B. find single source shortest path
C. find all pair shortest path algorithm
D. traverse the graph
Answer: A
Explanation: the Kruskal's algorithm is used to find the minimum spanning tree of the connected graph. It construct the MST by finding the edge having the least possible weight that connects two trees in the forest.

29. Kruskal's algorithm is a _____
A. divide and conquer algorithm
B. dynamic programming algorithm
C. greedy algorithm
D. approximation algorithm
Answer: C
Explanation: Kruskal's algorithm uses a greedy algorithm approach to find the MST of the connected weighted graph. In the greedy method, we attempt to find an optimal solution in stages.

30.What is the time complexity of Kruskal's algorithm?
A. $O(\log V)$
B. $O(E \log V)$
C. $O(E^2)$
D. $O(V \log E)$
Answer: B
Explanation: Kruskal's algorithm involves sorting of the edges, which takes $O(E \log E)$ time, where E is a number of edges in graph and V is the number of vertices. After sorting, all edges are iterated and union-find algorithm is applied. union-find algorithm requires $O(\log V)$ time. So, overall Kruskal's algorithm requires $O(E \log V)$ time.

31. Which of the given problems are NP-complete?
A. Node cover problems
B. Directed Hamilton Circuit Problem
C. Both (a) and (b)
D. None of the mentioned
Answer: C
Explanation: Vertex cover or Node cover problem, and Hamilton Circuit problem, both are NP complete type of problems.

32. 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. polynomial time
C. infinite time
D. none of the mentioned
Answer: B
Explanation: Most of the operations like addition, subtraction, etc as well as computing functions including powers, square roots and logarithms can be performed in polynomial time. In the given question, n is the complexity of the input and k is some non negative integer.

33. Which of the following statements are undecidable?
For a given Turing Machine M,
A. does M halt on an empty input tape
B. does M halt for only inputs at all?
C. is L(M) regular? Context free? Turing decidable?
D. all of the mentioned
Answer: D
Explanation: All of the following mentioned are immediate results of Rice's theorem and thus, undecidable.

34. A language L is said to be _____ if there is a turing machine M such that L(M)=L and M halts at every point.
A.) Turing acceptable
B. decidable
C. undecidable
D. none of the mentioned
Answer: B
Explanation: Decidability refers to the decision problem and existence of a effective method for determining membership, and return true and false accordingly rather that going into a loop forever.

35. The language accepted by a turing machine is called _____
A. Recursive Enumerable
B. Recursive
C. Both (a) and (b)
D. None of the mentioned
Answer: C
Explanation: The language accepted by Turing machines are called recursively enumerable (RE), and the subset of RE languages that are accepted by a turing machine that always halts are called recursive..

36. Decidable can be taken as a synonym to:
A. recursive
B. non recursive
C. recognizable

D. none of the mentioned
Answer: A
Explanation: We can refer to languages as 'recursive' and problems as 'decidable'. If a language is not recursive , then we call the problem expressed by that language undecidable.

37. A problem is called _____ if its has an efficient algorithm for
itself. A. tractable
B. intractable
C. computational
D. none of the mentioned
Answer: A
Explanation: A problem is called intractable iff there is an efficient (i.e. polynomial time) algorithm that solves it. A problem is called intractable iff there exists no efficient algorithm that solves it.
38. Recursive languages are also known as:
A. decidable
B. undecidable
C. sometimes decidable
D. none of the mentioned
Answer: A
Explanation: A language is recursive if there exists a turing machine such that it halts i.e. accepts if the input belongs to the language else rejects. It is better called Turing decidable language.

39. Which of the following problems is solvable?
A. Determining of a universal Turing machine and some input will halt
B. Determining of an arbitrary Turing machine is an universal Turing machine C.
Determining of a universal Turing machine can be written for fewer than k
instructions for some k
D. Writing a universal Turing machine
Answer: D
Explanation: Writing a universal Turing machine is solvable.

40. Recursive enumerable languages is also known as languages.
A. type 0
B. type 3
C. type 2
D. type 1
Answer: A
Explanation: Recursive enumerable languages is also known as TYPE 0 languages

41. The complement of recursive language is
a) Also recursive
b)Regular
c) Both (a) and (b)
d)None of these
Answer: a
Explanation: A recursive language is one that is accepted by a TM that halts on all inputs. The complement of a recursive language is recursive

42. Recursively enumerable language are closed under
a) Concatenation
b)Intersection
c) Union
d)All of these
Answer: d
Explanation: recursive and recursively enumerable languages are closed under union, concatenation, closure and intersection. The recursive languages are also closed under set difference and complementation.

43. Recursive languages are
a) Accepted by turing machine
b)Accepted by finite automata
c) Both (a) and (b)
d)None of these
Answer: a
Explanation: a formal language is recursive if there exists a total Turing machine (a Turing machine that halts for every given input) that, when given a finite sequence of symbols as input, accepts it if it belongs to the language and rejects it otherwise

44. 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
d. Deterministic Turing Machine
Answer: d
Explanation: All the decision problems that can be solved using a Deterministic turing machine using polynomial time to compute, all belong to the complexity class P.

45. A generalization of P class can be:
a. PTIME
b. DTIME

c. NP
d. None of mentioned
Answer: C
Explanation: P is a specific case of NP class, which is the class of decidable problems decidable by a non deterministic turing machine that runs in polynomial time.

46. Which of the following is a P-complete type of problem?
a. Circuit Value problem

b. Linear programming

c. CFG membership

d. All of the mentioned

Answer: d
Explanation : Given a context free grammar and a string, can the string be generated by the grammar? Such problems fall in the category of P-complete.

47. Travelling sales man problem belongs to which of the class?
a. P
b. NP
c. Linear
d. None of mentioned
Answer: b
Explanation : The traveling salesman problem (TSP) has commanded much attention from mathematicians and computer scientists specifically because it is so easy to describe and so difficult to solve. The TSP problem belongs in the class of such problems known as NP.

48. Which of the following can be used to define NP complexity class?
a. Verifier

b. Polynomial time

c. Both a and b

d. None of mentioned

Answer: c
Explanation : NP can be defined using deterministic turing machines as verifiers.

49. Decidable can be taken as synonym to
a. recursive
b. non recursive
c. recognizable
d. none of mentioned.
Answer: a
Explanation : we can refer languages as 'recursive' and problems are 'decidable'. if

language is not recursive, then we call the problem expressed by the language undecidable.

50. which of the following are undecidable problems?
a. determining whether two grammars generates the same languages
b. determining whether a grammar is ambiguous
c. Both a and b
d. None of mentioned.
Answer: c
Explanation : In contrast we can put an algorithm for checking whether two FA's are equivalent and this program can be implemented as a program.