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Text with Technology

Computer Science

Last Minute Suggestion

[500 Most Important Key Points]

1. A binary operation on a set of integers is defined as $x \cdot y = x^2 + y^2$. Which one of the following statements is TRUE about = **Commutative but not associative**
2. Which one of the following is NOT necessarily a property of a Group = **Commutativity**
3. How many different non-isomorphic Abelian groups of order 4 are there = **2**
4. The set of all non-singular matrices forms a group under = **multiplication**
5. The cardinality of the power set of $\{0, 1, 2, \dots, 10\}$ is = **20482**
6. A number of binary relations on a set with n elements is = **n^2**
7. Suppose A is a finite set with n elements. The number of elements in the largest equivalence relation of A is = **n^2**
8. The time complexity of computing the transitive closure of a binary relation on a set of n elements is known to be = **$O(n^3)$**
9. How many different equivalence relations with exactly three different equivalence classes are there on a set with five elements = **25**
10. The Servlet Response interface enables a servlet to formulate a response for a client using the method `_____int get` = **ServerPort()**
11. What is the maximum number of different Boolean functions involving n Boolean variables = **2^{2^n}**
12. How many 4-digit even numbers have all 4 digits distinct = **2296**
 [This is a basic permutation combination question. Considering two cases : numbers ending with 0 and not ending with 0: Numbers ending with 0 {first place: 0} *9{fourth place: 9 possibilities, 1-9} *8{third place: 8 possibilities left} *7{second place: 7 possibilities left} = 504 Numbers ending with non-0 4{first place: 2,4,6,8} *8{fourth place: 8 possibilities left, 1-9}*8{third place: 8 possibilities left b/w 0-9} *7{second place: 7 possibilities left b/w 0-9} = 2592 Total = 2296]
13. How many substrings of different length (non-zero) can be formed from a character string of length n = **$n(n+1)/2$**

14. The number of bit strings of length 8 that will either start with 1 or end with 00 is = **160**
15. There are 100 students. 85 choose Math, 80 choose Physics, 75 choose Chemistry, 70 choose Biology. What is the minimum number of students choosing all 4 subjects? Assume each student chosen at least one subject = **10**
16. n students appear in an examination, find the number of ways the result of examination can be announced.
= **2^n**
[Examples:
Input : $n = 6$
Output : Each student can either pass or fail in the examination. so ,there exists 2 possibilities for each of the 6 students in the result. hence total number of ways for the result= $(2)^6$
Input : $n = 8$
Output : $(2)^8=256$]
17. n matches are to be played in class a chess tournament, find the number of ways in which their results can be decided = **$(3)^n$ ways**
[Examples:
Input : $n = 3$
Output: The results of each of the 3 matches can be three ways namely win ,draw or loss since total no. of ways in which results of 3 matches can be decided $= (3)^3$
Input: 6
Output: $(3)^4=81$]
18. A badminton tournament consists of ' n ' matches.
(i) Find the number of ways in which their results can be forecast are given.
(ii) Total number of forecasts containing all correct results.
(iii) Total number of forecasts containing all wrong results.
= **(2^n)**
19. Find the number of ways in which ' n ' different beads can be arranged to form a necklace = **$(n-1)!/2$**
20. There are ' n ' questions papers, find the no, of ways in which a student can attempt one or more questions = **(2^n-1) ways.**
[For example a student will solve one or more questions out of 4 questions in following ways.
1) The student chooses to solve only one question, can choose in 4C_1
2) The student chooses to solve only two questions, can choose in 4C_2
3) The student chooses to solve only three questions, can choose in 4C_3
3) The student chooses to solve all four questions, can choose in 4C_4
So total ways are ${}^4C_1 + {}^4C_2 + {}^4C_3 + {}^4C_4$
 $= 2^4 - 1 = 15$ ways
We know sum of binomial coefficients from nC_0 to nC_n is 2^n]

21. Given a polygon of m sides, count number of triangles that can be formed using vertices of polygon.
 $= \frac{m(m-1)(m-2)}{6}$
 [There are m vertices in a polygon with m sides. We need to count different combinations of three points chosen from m . So answer is ${}^mC_3 = \frac{m * (m-1) * (m-2)}{6}$
 Examples:
 Input: $m = 3$
 Output: 1
 We put value of $m = 3$, we get required no. of triangles $= \frac{3 * 2 * 1}{6} = 1$
 Input : $m = 6$
 output : 20]
22. **Given a polygon of m sides, count number of diagonals that can be formed using vertices of polygon**
 $= \frac{m(m-3)}{2}$
 [Explanation : We need to choose two vertices from polygon. We can choose first vertex m ways. We can choose second vertex in $m-3$ ways (Note that we can not choose adjacent two vertices to form a diagonal). So total number is $m * (m-3)$. This is twice the total number of combinations as we consider an diagonal edge $u-v$ twice ($u-v$ and $v-u$)
 Examples:
 Input $m = 4$
 output: 2
 We put the value of $m = 4$, we get the number of required diagonals $= \frac{4 * (4-3)}{2} = 2$
 Input: $m = 5$
 Output: 5]
23. Count the total number rectangles that can be formed using m vertical lines and n horizontal lines
 $= ({}^mC_2 * {}^nC_2)$.
 [We need to choose two vertical lines and two horizontal lines. Since the vertical and horizontal lines are chosen independently, we multiply the result.
 Examples:
 Input: $m = 2, n = 2$
 Output: 1
 We have the total no of rectangles
 $= {}^2C_2 * {}^2C_2$
 $= 1 * 1 = 1$
 Input: $m = 4, n = 4$
 Output: 36]

24. There are 'n' points in a plane, out of which 'm' points are co-linear. Find the number of triangles formed by the points as vertices = **Number of triangles = ${}^nC_3 - {}^mC_3$**
 [Consider the example $n = 10, m = 4$. There are 10 points, out of which 4 collinear. A triangle will be formed by any three of these ten points. Thus forming a triangle amounts to selecting any three of the 10 points. Three points can be selected out of the 10 points in ${}^{10}C_3$ ways.
 Number of triangles formed by 10 points when no 3 of them are co-linear = ${}^{10}C_3$(i)
 Similarly, the number of triangles formed by 4 points when no 3 of them are co-linear = 4C_3(ii)
 Since triangle formed by these 4 points are not valid, required number of triangles formed = ${}^{10}C_3 - {}^4C_3 = 120 - 4 = 116$]
25. There are 'n' points in a plane out of which 'm' points are collinear, count the number of distinct straight lines formed by joining two points = **${}^nC_2 - {}^mC_2 + 1$**
 [Number of straight lines formed by n points when none of them are col-linear = nC_2
 Similarly, the number of straight lines formed by m points when none of them collinear = mC_2
 m points are collinear and reduce in one line. Therefore we subtract mC_2 and add 1.
 Hence answer = ${}^nC_2 - {}^mC_2 + 1$
 Examples:
 Input : $n = 4, m = 3$
 output : 1
 We apply this formula
 Answer = ${}^4C_2 - {}^3C_2 + 1$
 $= 3 - 3 + 1$
 $= 1$]
26. Out of all the 2-digit integers between 1 and 100, a 2-digit number has to be selected at random. What is the probability that the selected number is not divisible by 7 = **$77/90$**
 [There are total 90 two digit numbers, out of them 13 are divisible by 7, these are 14, 21, 28, 35, 42, 49, 56, 63, 70, 77, 84, 91, 98.
 Therefore, probability that selected number is not divisible by 7 = $1 - 13/90 = 77/90$]
27. Suppose a fair six-sided die is rolled once. If the value on the die is 1, 2, or 3, the die is rolled a second time. What is the probability that the sum total of values that turn up is at least 6 = **$5/12$**
 [The following are different possibilities
 (1,5) (1,6) (2,4) (2,5) (2,6) (3,3) (3,4) (3,5) (3,6)
 Plus 1/6 probability that first time 6 is rolled
 So total probability is $9/36 + 1/6 = 15/36 = 5/12$]

28. Consider a random variable X that takes values $+1$ and -1 with probability 0.5 each. The values of the cumulative distribution function $F(x)$ at $x = -1$ and $+1$ are 0.5 and 1

[Explanation: The Cumulative Distribution Function

$$F(x) = P(X \leq x)$$

$$F(-1) = P(X \leq -1) = P(X = -1) = 0.5$$

$$F(+1) = P(X \leq +1) = P(X = -1) + P(X = +1) = 0.5 + 0.5 = 1]$$

29. If two fair coins are flipped and at least one of the outcomes is known to be a head, what is the probability that both outcomes are heads = $1/3$

[Since we know one outcome is head, there are only three possibilities $\{h, t\}$, $\{h, h\}$, $\{t, h\}$ The probability of both heads = $1/3$]

30. If the difference between expectation of the square of a random variable ($E[X^2]$) and the square of the expectation of the random variable ($E[X]^2$) is denoted by R , then = $R \geq 0$

[The difference between ($E[X^2]$) and ($E[X]^2$) is called variance of a random variable. Variance measures how far a set of numbers is spread out. (A variance of zero indicates that all the values are identical.) A non-zero variance is always positive]

31. A random bit string of length n is constructed by tossing a fair coin n times and setting a bit to 0 or 1 depending on outcomes head and tail, respectively. The probability that two such randomly generated strings are not identical is = $1 - (1/2^n)$

[<!--

The probability that the two strings are identical is

$(1/2) * (1/2) * \dots * (1/2)$ (n times) which is $1/2^n$

The probability for not identical is $1 - (1/2^n)$

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let us suppose if outcome is head $\Rightarrow 0$, tail $\Rightarrow 1$

Since the coin is fair, $P(H) = P(T) = 1/2$

Length of the string is $\Rightarrow n$

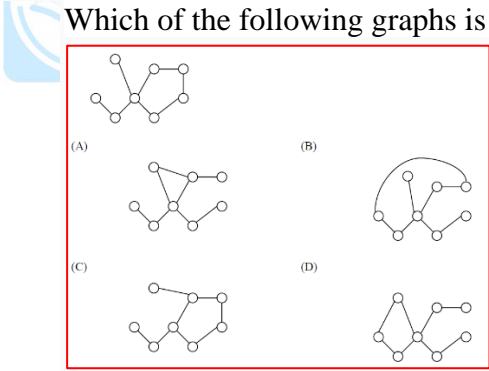
$P(X)$ = both the strings should not be identical

$P(-X)$ = both are not identical = $1 - P(X)$

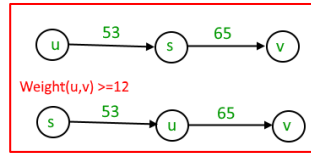
If both the strings are equal, every character should be same w.r.t its positions

i.e $P(X) = 1/2 * 1/2 * \dots (n \text{ times}) = (1/2)^n$

$P(-X) = 1 - (1/2)^n]$

32. An examination paper has 150 multiple-choice questions of one mark each, with each question having four choices. Each incorrect answer fetches -0.25 mark. Suppose 1000 students choose all their answers randomly with uniform probability. The sum total of the expected marks obtained by all these students is = **9375**
33. A point is randomly selected with uniform probability in the X-Y plane within the rectangle with corners at (0,0), (1,0), (1,2) and (0,2). If p is the length of the position vector of the point, the expected value of p^2 is = **5/3**
34. A bag contains 10 blue marbles, 20 green marbles and 30 red marbles. A marble is drawn from the bag, its colour recorded and it is put back in the bag. This process is repeated 3 times. The probability that no two of the marbles drawn have the same colour is = **1/6**
 [As number of colors is 3, Possible combinations $\rightarrow 3! = 6$
 Probability of Blue marble: $10/60$
 Probability of Green marble: $20/60$
 Probability of Red marble: $30/60$
 Probability that no two of the marbles drawn have the same colour is $= 6 * (10/60 * 20/60 * 30/60) = 1/6$]
35. A probability density function on the interval $[a, 1]$ is given by $1/x^2$ and outside this interval the value of the function is zero. The value of a is = **0.5**
36. Which of the following graphs is isomorphic to = **B**
- 
37. Consider an undirected random graph of eight vertices. The probability that there is an edge between a pair of vertices is $1/2$. What is the expected number of unordered cycles of length three = **7**
38. What is the chromatic number of an n -vertex simple connected graph which does not contain any odd length cycle = **$n \geq 2$**
39. If G is a forest with n vertices and k connected components, how many edges does G have = **$n-k$**
 [Each component will have n/k vertices (pigeonhole principle). Hence, for each component there will be $(n/k)-1$ edges. Since there are k components, total number of edges $= k*((n/k)-1) = n-k$.]
40. How many perfect matchings are there in a complete graph of 6 vertices = **15**

41. The minimum number of colours that is sufficient to vertex-colour any planar graph is = **4**
42. Consider a weighted undirected graph with positive edge weights and let uv be an edge in the graph. It is known that the shortest path from the source vertex s to u has weight 53 and the shortest path from s to v has weight 65. Which one of the following statements is always true = **weight $(u, v) \geq 12$**



43. A graph in which all nodes are of equal degree, is known as = **Regular graph**
44. In a graph G there is one and only one path between every pair of vertices then G is a = **Tree**
45. If G is a graph with e edges and n vertices, the sum of the degrees of all vertices in G is = **$2e$**
46. The number of distinct simple graphs with up to three nodes is = **7**
47. The maximum number of edges in a n -node undirected graph without self loops is = **$n * (n-1)/2$**
48. Every NFA can be converted to an equivalent DFA, Every non-deterministic Turing machine can be converted to an equivalent deterministic Turing machine, Every regular language is also a context = **free language**
49. The length of the shortest string NOT in the language (over $\Sigma = \{a, b\}$) of the following regular expression is $a^*b^*(ba)^*a^* =$ **3**
50. What can be said about a regular language L over $\{a\}$ whose minimal finite state automaton has two states = **Either L must be $\{a^n \mid n \text{ is odd}\}$, or L must be $\{a^n \mid n \text{ is even}\}$**
51. How many minimum states are required in a DFA to find whether a given binary string has odd number of 0's or not, there can be any number of 1's = **2**
52. Which of the following languages is generated by the given grammar = **$S \rightarrow aS|bS \mid \epsilon, \epsilon = \{a, b\}^*$**
53. the following regular expressions, is describing a language of binary numbers (MSB to LSB) that represents non-negative decimal values, does not include even values = **$0^*1^*0^*1^+$**
54. For $\Sigma = \{a, b\}$ the regular expression $r = (aa)^*(bb)^*b$ denotes = **Set of strings with even number of a 's followed by odd number of b 's**

55. The logic of pumping lemma is an example of = **the pigeon – hole principle**
 [Pigeon-hole principle states that if there are n pigeons fly into m hole and $n > m$ then atleast one hole must contain more than one pigeons. And logic of pumping lemma states that- finite state automaton can assume only a finite number of states and because there are infinitely many input sequence, by the pigeon hole principle, there must be atleast one state to which the automata returns over and over again.]
56. Minimal deterministic finite automaton for the language $L = \{0^n \mid n \geq 0, n \neq 4\}$ will have = **5 final states among 6 states**
57. The number of states in the minimum sized DFA that accepts the language defined by the regular expression $(0+1)^*(0+1)(0+1)^*$ is = **2**
58. Consider an ambiguous grammar G and its disambiguated version D . Let the language recognized by the two grammars be denoted by $L(G)$ and $L(D)$ respectively. = **$L(D) = L(G)$**
59. Pumping lemma for regular language is generally used for proving = **a given grammar is not regular**
60. **Properties of Compound Finite Automata (FA):**
 I) Number of states in compound FA ($D1 \times D2$) is equal to $m \times n$, where m is the number of states in $D1$ and n is the number of states $D2$.
 II) Initial state of compound FA is combination of initial states of $D1$ and $D2$.
 III) Final state of compound FA depends on the operation performed.
61. **Deterministic Finite Automata (DFA)**
- DFA consists of 5 tuples $\{Q, \Sigma, q, F, \delta\}$.
 - Q : set of all states.
 - Σ : set of input symbols. (Symbols which machine takes as input)
 - q : Initial state. (Starting state of a machine)
 - F : set of final state.
 - δ : Transition Function, defined as $\delta : Q \times \Sigma \rightarrow Q$.
- [In a DFA, for a particular input character, the machine goes to one state only. A transition function is defined on every state for every input symbol. Also in DFA null (or ϵ) move is not allowed, i.e., DFA cannot change state without any input character.]
62. 1. Every DFA is NFA but not vice versa.
 2. Both NFA and DFA have same power and each NFA can be translated into a DFA.
 3. There can be multiple final states in both DFA and NFA.
 4. NFA is more of a theoretical concept.
 5. DFA is used in Lexical Analysis in Compiler.

63. A Pushdown Automata (PDA) can be defined as :

- Q is the set of states
- Σ is the set of input symbols
- Γ is the set of pushdown symbols (which can be pushed and popped from stack)
- q_0 is the initial state
- Z is the initial pushdown symbol (which is initially present in stack)
- F is the set of final states
- δ is a transition function which maps $Q \times \{\Sigma \cup \epsilon\} \times \Gamma$ into $Q \times \Gamma^*$. In a given state, PDA will read input symbol and stack symbol (top of the stack) and move to a new state and change the symbol of stack.

64. Instantaneous Description (ID)

Instantaneous Description (ID) is an informal notation of how a PDA “computes” a input string and make a decision that string is accepted or rejected.

A ID is a triple (q, w, α) , where:

1. q is the current state.
2. w is the remaining input.
3. α is the stack contents, top at the left.

[Turnstile notation

\vdash sign is called a “turnstile notation” and represents one move.

\vdash^* sign represents a sequence of moves.

Eg- $(p, b, T) \vdash (q, w, \alpha)$

This implies that while taking a transition from state p to state q , the input symbol ‘ b ’ is consumed, and the top of the stack ‘ T ’ is replaced by a new string ‘ α ’]

65. Pairs have DIFFERENT expressive power = **Deterministic push down automata(DPDA)and Non-deterministic push down automata**

66. $S \rightarrow aSa|bSb|a|b$; The language generated by the above grammar over the alphabet $\{a,b\}$ is the set of = **All odd length palindromes**

67. Context free languages are closed under = **Union, Kleene closure**

68. Regarding the power of recognition of languages=

- (a) The non-deterministic finite state automata are equivalent to deterministic finite state automata.
- (b) Non-deterministic Turing machines are equivalent to deterministic Turing machines.
- (c) Multi-tape Turing machines are equivalent to Single-tape Turing machines.

69. If all the production rules have single non – terminal symbol on the left side, the grammar defined is = **context free grammar**
70. For every non-deterministic Turing machine =
a)there exists an equivalent deterministic Turing machine.
b) Turing recognizable languages are closed under union and complementation.
c) Turing recognizable languages are closed under union and intersection.
71. If L and L' are recursively enumerable, then L is = **recursive**
72. A language L is called Turing-decidable (or just decidable), if there exists a Turing Machine M such that on input x, M accepts if $x \in L$, and M rejects otherwise. L is called undecidable if it is not decidable =
(A) The class of decidable languages is closed under complement.
(B) The class of decidable languages is closed under union
(C) The class of decidable languages is closed under intersection
73. The set of all recursively enumerable languages is = **closed under intersection.**
74. A problem whose language is recursive is called = **Decidable**
75. Let S and T be language over $\{a,b\}$ represented by the regular expressions $(a+b^*)^*$ and $(a+b)^*$, respectively = **S=T**
76. Let L denotes the language generated by the grammar $S \rightarrow OSO/00$ = **L is regular but not O. that grammar itself is not regular but language L is regular as L can be represented using a regular grammar, for example $S \rightarrow S00/00$.**
77. The union of two context free languages is context free = **Context-free languages are closed under the following operations. That is, if L and P are context-free languages and D is a regular language, the following languages are context-free as well:**
• the Kleene star L^* of L
• the image $\phi(L)$ of L under a homomorphism ϕ
• the concatenation of L and P
• the union of L and P
• the intersection of L with a regular language D ($L \cap D$).
Context-free languages are not closed under complement, intersection, or difference.

78. Given an arbitrary non-deterministic finite automaton (NFA) with N states, the maximum number of states in an equivalent minimized DFA is at least $= 2^N$
79. $\{wxw^R \mid w, x \in (a+b)^+\}$
- (A) It is correct, since this language can form regular expression which is $\{a(a+b)^+a\} + \{b(a+b)^+b\}$, i.e., start and end with same symbol.
- (B) It is deterministic context free language since, string before and after 'x' are same so, it is matched.
- (C) It cannot be regular since, ww^R is done at first which requires comparison which cannot be done via finite automata.
- (D) It is also not regular since, comparison is required.
80. If L is a regular language, then is L' also regular?
If L is a recursive language, then, is L' also recursive?
- 1) Is a variation of Turing Machine Halting problem and it is undecidable.
 - 2) Context Free Languages are not closed under intersection and complement. See this for details.
 - 3) Complement of Regular languages is also regular. Then a DFA that accepts the complement of L , i.e. $\Sigma^* - L$, can be obtained by swapping its accepting states with its non-accepting states.
 - 4) Recursive Languages are closed under complement.
81. **Moore Machines:** Moore machines are finite state machines with output value and its output depends only on present state.
- [It can be defined as $(Q, q_0, \Sigma, O, \delta, \lambda)$ where:
- Q is finite set of states.
 - q_0 is the initial state.
 - Σ is the input alphabet.
 - O is the output alphabet.
 - δ is transition function which maps $Q \times \Sigma \rightarrow Q$.
 - λ is the output function which maps $Q \rightarrow O$.]
82. **Mealy Machines:** Mealy machines are also finite state machines with output value and its output depends on present state and current input symbol.
- [It can be defined as $(Q, q_0, \Sigma, O, \delta, \lambda')$ where:
- Q is finite set of states.
 - q_0 is the initial state.
 - Σ is the input alphabet.
 - O is the output alphabet.
 - δ is transition function which maps $Q \times \Sigma \rightarrow Q$.
 - ' λ' ' is the output function which maps $Q \times \Sigma \rightarrow O$.]

83. Unrestricted Grammar:

In Type 0

Type-0 grammars include all formal grammars. Type 0 grammar language are recognized by turing machine. These languages are also known as the Recursively Enumerable languages.

[Grammar Production in the form of

where

is $(V + T)^* V (V + T)^*$

V : Variables

T : Terminals.

is $(V + T)^*$.

In type 0 there must be at least one variable on Left side of production.]

84. Context Sensitive Grammar)

Type-1 grammars generate the context-sensitive languages. The language generated by the grammar are recognized by the Linear Bound Automata

[In Type 1

I. First of all Type 1 grammar should be Type 0.

II. Grammar Production in the form of

$|V| \leq |T|$

i.e count of symbol in V is less than or equal to T]

85. Context Free Grammar:

Type-2 grammars generate the context-free languages. The language generated by the grammar is recognized by a Pushdown automata. Type-2 grammars generate the context-free languages.

[In Type 2,

1. First of all it should be Type 1.

2. Left hand side of production can have only one variable.

$|V| = 1$.

There is no restriction on T.]

86. Regular Grammar:

Type-3 grammars generate regular languages. These languages are exactly all languages that can be accepted by a finite state automaton.

[Type 3 is most restricted form of grammar.

Type 3 should be in the given form only :

$V \rightarrow VT^* / T^*$.

(or)

$V \rightarrow T^*V / T^*$]

87. Pumping Lemma for Regular Languages

For any regular language L , there exists an integer n , such that for all $x \in L$ with $|x| \geq n$, there exists $u, v, w \in \Sigma^*$, such that $x = uvw$, and

- (1) $|uv| \leq n$
- (2) $|v| \geq 1$
- (3) for all $i \geq 0$: $uv^i w \in L$

88. Pumping Lemma for Context-free Languages (CFL)

Pumping Lemma for CFL states that for any Context Free Language L , it is possible to find two substrings that can be 'pumped' any number of times and still be in the same language. For any language L , we break its strings into five parts and pump second and fourth substring.

[Pumping Lemma, here also, is used as a tool to prove that a language is not CFL. Because, if any one string does not satisfy its conditions, then the language is not CFL.]

Thus, if L is a CFL, there exists an integer n , such that for all $x \in L$ with $|x| \geq n$, there exists $u, v, w, x, y \in \Sigma^*$, such that $x = uvwxy$, and

- (1) $|vwx| \leq n$
- (2) $|vx| \geq 1$
- (3) for all $i \geq 0$: $uv^iwx^iy \in L$

89. Steps to Convert NFA with ϵ -move to DFA :

Step 1 : Take ϵ closure for the beginning state of NFA as beginning state of DFA.

Step 2 : Find the states that can be traversed from the present for each input symbol

(union of transition value and their closures for each states of NFA present in current state of DFA).

Step 3 : If any new state is found take it as current state and repeat step 2.

Step 4 : Do repeat Step 2 and Step 3 until no new state present in DFA transition table.

Step 5 : Mark the states of DFA which contains final state of NFA as final states of DFA

90. Minimization of DFA:

Suppose there is a DFA $D = \langle Q, \Sigma, q_0, \delta, F \rangle$ which recognizes a language L . Then the minimized DFA $D' = \langle Q', \Sigma, q_0', \delta', F' \rangle$ can be constructed for language L as:

Step 1: We will divide Q (set of states) into two sets. One set will contain all final states and other set will contain non-final states. This partition is called P_0 .

Step 2: Initialize $k = 1$

Step 3: Find P_k by partitioning the different sets of P_{k-1} . In each set of P_{k-1} , we will take all possible pair of states. If two states of a set are distinguishable, we will split the sets into different sets in P_k .

Step 4: Stop when $P_k = P_{k-1}$ (No change in partition)

Step 5: All states of one set are merged into one. No. of states in minimized DFA will be equal to no. of sets in P_k .

91. Star height is also defined for regular expressions as the maximum nesting depth of Kleene stars appearing in that expression. In order to state star height, “h” of a regular expression formally, one can write as,
- $h(\epsilon) = 0$, where ϵ is the empty set
 $h(\epsilon) = 0$, where ϵ is the empty string
 $h(t) = 0$, where t may be any terminal symbol of an alphabet set
 $h(EF) = \max(h(E), h(F))$, where E, F denotes regular expressions
 $h(E^*) = h(E) + 1$
92. **Language generated by a grammar –**
- For a given grammar G, its corresponding language L(G) is unique.
 - The language L(G) corresponding to grammar G must contain all strings which can be generated from G.
 - The language L(G) corresponding to grammar G must not contain any string which can not be generated from G.
93. **Convert CFG to GNF –**
- Step 1. Convert the grammar into CNF.
If the given grammar is not in CNF, convert it to CNF. You can refer following article to convert CFG to CNF: [Converting Context Free Grammar to Chomsky Normal Form](#)
 - Step 2. Eliminate left recursion from grammar if it exists.
If CFG contains left recursion, eliminate them. You can refer following article to eliminate left recursion: [Parsing | Set 1 \(Introduction, Ambiguity and Parsers\)](#)
 - Step 3. Convert the production rules into GNF form.
94. **Ambiguous Context Free Grammar: A context free grammar is called ambiguous if there exists more than one LMD or more than one RMD for a string which is generated by grammar. There will also be more than one derivation tree for a string in ambiguous grammar**
95. If a context free grammar G is ambiguous, language generated by grammar L(G) may or may not be ambiguous
- It is not always possible to convert ambiguous CFG to unambiguous CFG. Only some ambiguous CFG can be converted to unambiguous CFG.
 - There is no algorithm to convert ambiguous CFG to unambiguous CFG.
 - There always exist a unambiguous CFG corresponding to unambiguous CFL.
 - Deterministic CFL are always unambiguous.
96. **Hamming Code in Computer Network**
- Hamming code is a set of error-correction codes that can be used to **detect and correct the errors** that can occur when the data is moved or stored from the sender to the receiver. It is **technique developed by R.W. Hamming for error correction**

97. Parity bits –

A parity bit is a bit appended to a data of binary bits to ensure that the total number of 1's in the data are even or odd. Parity bits are used for error detection. There are two types of parity bits

Even parity bit-

In the case of even parity, for a given set of bits, the number of 1's are counted. If that count is odd, the parity bit value is set to 1, making the total count of occurrences of 1's an even number. If the total number of 1's in a given set of bits is already even, the parity bit's value is 0.

Odd Parity bit –

In the case of odd parity, for a given set of bits, the number of 1's are counted. If that count is even, the parity bit value is set to 1, making the total count of occurrences of 1's an odd number. If the total number of 1's in a given set of bits is already odd, the parity bit's value is 0.

98. Pigeonhole principle strong form –

Theorem: Let q_1, q_2, \dots, q_n be positive integers.

If $q_1 + q_2 + \dots + q_n - n + 1$ objects are put into n boxes, then either the 1st box contains at least q_1 objects, or the 2nd box contains at least q_2 objects, \dots , the n th box contains at least q_n objects.

99. Euler paths and circuits :

- An Euler path is a path that uses every edge of a graph exactly once.
- An Euler circuit is a circuit that uses every edge of a graph exactly once.
- An Euler path starts and ends at different vertices.
- An Euler circuit starts and ends at the same vertex.

100. The minimum number of comparisons required to determine if an integer appears more than $n/2$ times in a sorted array of n integers is = $\Theta(\log n)$ **101. Types of indexing in array:**

- 0 (zero-based indexing): The first element of the array is indexed by subscript of 0
- 1 (one-based indexing): The first element of the array is indexed by subscript of 1
- n (n-based indexing): The base index of an array can be freely chosen. Usually programming languages allowing n-based indexing also allow negative index values and other scalar data types like enumerations, or characters may be used as an array index.

102. Flatten array = Returns a new array that is a one-dimensional flattening of self (recursively). That is, for every element that is an array, extract its elements into the new array. The optional level argument determines the level of recursion to flatten.

103. Array declaration by specifying size:

```
filter_none
brightness_4

// Array declaration by specifying size
int arr1[10];

// With recent C/C++ versions, we can also
// declare an array of user specified size
int n = 10;
int arr2[n];
```

104. Array declaration by initializing elements

```
filter_none
brightness_4

// Array declaration by initializing elements
int arr[] = { 10, 20, 30, 40 }

// Compiler creates an array of size 4.
// above is same as "int arr[4] = {10, 20, 30, 40}"
```

105. Application of Stack Data Structure = **Managing function calls, The stock span problem, Arithmetic expression evaluation**

106. About linked list implementation of stack = **To keep the Last In First Out order, a stack can be implemented using linked list in two ways:**

- a) **In push operation, if new nodes are inserted at the beginning of linked list, then in pop operation, nodes must be removed from beginning.**
- b) **In push operation, if new nodes are inserted at the end of linked list, then in pop operation, nodes must be removed from end.**

107. To evaluate an expression without any embedded function calls = **One stack is enough**

108. A priority queue Q is used to implement a stack S that stores characters. PUSH(C) is implemented as INSERT (Q, C, K) where K is an appropriate integer key chosen by the implementation. POP is implemented as DELETETEMIN(Q). For a sequence of operations, the keys chosen are in = **strictly decreasing order**

109. The minimum number of stacks needed to implement a queue is = **2**

110. The best data structure to check whether an arithmetic expression has balanced parenthesis is a = **Stack**
111. inherent application of stack = **Implementation of recursion, Evaluation of a postfix expression, Reverse a string**
112. **Time Complexity:** $O(n)$. It seems more than $O(n)$ at first look. If we take a closer look, we can observe that every element of array is added and removed from stack at most once. So there are total $2n$ operations at most. Assuming that a stack operation takes $O(1)$ time, we can say that the time complexity is $O(n)$.
113. **Auxiliary Space:** $O(n)$ in worst case when all elements are sorted in decreasing order.
114. **Iterative Algorithm:**
1. Calculate the total number of moves required i.e. " $2^n - 1$ " here n is number of disks.
 2. If number of disks (i.e. n) is even then interchange destination pole and auxiliary pole.
 3. for $i = 1$ to total number of moves:
 - if $i \% 3 == 1$:
legal movement of top disk between source pole and destination pole
 - if $i \% 3 == 2$:
legal movement top disk between source pole and auxiliary pole
 - if $i \% 3 == 0$:
legal movement top disk between auxiliary pole and destination pole
115. Application of Queue Data Structure=**When a resource is shared among multiple consumers, When data is transferred asynchronously (data not necessarily received at same rate as sent) between two processes, Load Balancing**
116. stacks are needed to implement a queue. Consider the situation where no other data structure like arrays, linked list is available to you = **2**
117. queues are needed to implement a stack. Consider the situation where no other data structure like arrays, linked list is available to you = **2**
118. **Priority Queue is an extension of queue with following properties.**
1. Every item has a priority associated with it.
 2. An element with high priority is de-queued before an element with low priority.
 3. If two elements have the same priority, they are served according to their order in the queue.

119. Operations on Deque:

Mainly the following four basic operations are performed on queue:

insertFront(): Adds an item at the front of Deque.

insertLast(): Adds an item at the rear of Deque.

deleteFront(): Deletes an item from front of Deque.

deleteLast(): Deletes an item from rear of Deque.

120. About Linked List data structure when it is compared with array

(A) Arrays have better cache locality that can make them better in terms of performance.

(B) It is easy to insert and delete elements in Linked List

(C) Random access is not allowed in a typical implementation of Linked Lists

(D) The size of array has to be pre-decided, linked lists can change their size any time.

121. Which is the sorting algorithms can be used to sort a random linked list with minimum time complexity = Merge Sort

122. In the worst case, the number of comparisons needed to search a singly linked list of length n for a given element is = n

123. The time required to search an element in a linked list of length n is = O(n)

124. Operations is performed more efficiently by doubly linked list than by linear linked list = Deleting a node whose location is given

125. What is the time complexity of Build Heap operation. Build Heap is used to build a max(or min) binary heap from a given array. Build Heap is used in Heap Sort as a first step for sorting = O(n)

126. Consider a binary max-heap implemented using an array = 25,14,16,13,10,8,12
[A tree is max-heap if data at every node in the tree is greater than or equal to it's children' s data]

127. The following Binary Min Heap operation has the highest time complexity = Merging with another heap under the assumption that the heap has capacity to accommodate items of other heap

128. Languages necessarily need heap allocation in the run time environment = Those that allow dynamic data structures

129. A Heap is a special Tree-based data structure in which the tree is a complete binary tree. Generally, Heaps can be of two types:

- 1. Max-Heap:** In a Max-Heap the key present at the root node must be greatest among the keys present at all of it's children. The same property must be recursively true for all sub-trees in that Binary Tree.
- 2. Min-Heap:** In a Min-Heap the key present at the root node must be minimum among the keys present at all of it's children. The same property must be recursively true for all sub-trees in that Binary Tree.

130. A full binary tree (sometimes proper binary tree or 2-tree or strictly binary tree) is a tree in which every node other than the leaves has two children. A complete binary tree is a binary tree in which every level, except possibly the last, is completely filled, and all nodes are as far left as possible.
131. The maximum number of binary trees that can be formed with three unlabelled nodes is = 5
132. The height of a binary tree is the maximum number of edges in any root to leaf path. The maximum number of nodes in a binary tree of height h is = $2^{(h+1)} - 1$
133. What is the maximum height of any AVL tree with 7 nodes? Assume that height of tree with single node is 0 = 3
134. Consider a full binary tree with n internal nodes, internal path length i , and external path length e . The internal path length of a full binary tree is the sum, taken over all nodes of the tree, of the depth of each node. Similarly, the external path length is the sum, taken over all leaves of the tree, of the depth of each leaf. Which of the following is correct for the full binary tree = $e = i + 2n$
135. What is the worst case time complexity for search, insert and delete operations in a general Binary Search Tree = $O(n)$ for all
136. In delete operation of BST, we need inorder successor (or predecessor) of a node when the node to be deleted has both left and right child as non-empty. Which of the following is true about inorder successor needed in delete operation = Inorder successor is always either a leaf node or a node with empty left child
 [Explanation: Let X be the node to be deleted in a tree with root as 'root'. There are three cases for deletion
 1) X is a leaf node: We change left or right pointer of parent to NULL (depending upon whether X is left or right child of its parent) and we delete X
 2) One child of X is empty: We copy values of non-empty child to X and delete the non-empty child
 3) Both children of X are non-empty: In this case, we find inorder successor of X . Let the inorder successor be Y . We copy the contents of Y to X , and delete Y .]
137. Traversal outputs the data in sorted order in a BST = Inorder
138. Access time of the symbolic table will be logarithmic if it is implemented by = Search tree
139. The average depth of a binary search tree is = $O(\log n)$
140. The worst-case running time to search for an element in a balanced in a binary search tree with n^2 elements is = C

141. The worst-case possible height of AVL tree = $1.44 \log n$, assume base of log is 2
142. A self-adjusting or self-balancing Binary Search Tree = **Splay Tree, AVL Tree, Red Black Tree**
143. The AVL trees are more balanced compared to Red Black Trees, but they may cause more rotations during insertion and deletion
144. **Red Black Trees** = The path from the root to the furthest leaf is no more than twice as long as the path from the root to the nearest leaf, In AVL tree insert() operation, we first traverse from root to newly inserted node and then from newly inserted node to root. While in Red Black tree insert(), we only traverse once from root to newly inserted node.
145. What is common in three different types of traversals = **Left subtree is always visited before right subtree**
146. Which traversal of tree resembles the breadth first search of the graph = **Level order**
147. Which of the following tree traversal uses a queue data structure = **Level order**
148. Can generate the full binary tree = **Inorder and Preorder, Inorder and Postorder, Preorder and Postorder**
149. If all the edge weights of an undirected graph are positive, then any subset of edges that connects all the vertices and has minimum total weight is a = **tree**
150. The following advantage of adjacency list representation over adjacency matrix representation of a graph
(A) In adjacency list representation, space is saved for sparse graphs.
(B) DFS and BSF can be done in $O(V + E)$ time for adjacency list representation. These operations take $O(V^2)$ time in adjacency matrix representation. Here is V and E are number of vertices and edges respectively.
(C) Adding a vertex in adjacency list representation is easier than adjacency matrix representation.
151. The time complexity of computing the transitive closure of a binary relation on a set of n elements is known to be = $O(n^3)$
152. The most efficient algorithm for finding the number of connected components in an undirected graph on n vertices and m edges has time complexity = $\theta(m + n)$
153. Which is the data structure is useful in traversing a given graph by breadth first search = **Queue**

154. If we want to search any name in the phone directory , which is the most efficient data structure = **Trie**
155. Which algorithm can be used to most efficiently determine the presence of a cycle in a given graph = **Depth First Search**
156. Traversal of a graph is different from tree because = **There can be a loop in graph so we must maintain a visited flag for every vertex**
157. Which of the following condition is sufficient to detect cycle in a directed graph = **There is an edge from currently being visited node to an ancestor of currently visited node in DFS forest.**
158. In a depth-first traversal of a graph G with n vertices, k edges are marked as tree edges. The number of connected components in G is = **$n - k$**
159. In BFS, we start with a node:
- 1) Create a queue and enqueue source into it.
Mark source as visited.
 - 2) While queue is not empty, do following
 - a) Dequeue a vertex from queue. Let this be f .
 - b) Print f
 - c) Enqueue all not yet visited adjacent of f and mark them visited
160. An index is clustered, if = **the data records of the file are organized in the same order as the data entries of the index.**
161. A clustering index is defined on the fields which are of type = **non-key and ordering**
162. A FAT (file allocation table) based file system is being used and the total overhead of each entry in the FAT is 4 bytes in size. Given a 100×10^6 bytes disk on which the file system is stored and data block size is 10^3 bytes, the maximum size of a file that can be stored on this disk in units of 10^6 bytes is = **99.55 to 99.65**
163. In the index allocation scheme of blocks to a file, the maximum possible size of the file depends on = **the number of blocks used for the index, and the size of the blocks.**
164. A file is organized so that the ordering of data records is the same as or close to the ordering of data entries in some index. Then that index is called = **Clustered**

165. B+-tree=

Most queries can be executed more quickly if the values are stored in order. But it's not practical to hope to store all the rows in the table one after another, in sorted order, because this requires rewriting the entire table with each insertion or deletion of a row.

This leads us to instead imagine storing our rows in a tree structure. Our first instinct would be a balanced binary search tree like a red-black tree, but this really doesn't make much sense for a database since it is stored on disk. You see, disks work by reading and writing whole blocks of data at once — typically 512 bytes or four kilobytes. A node of a binary search tree uses a small fraction of that, so it makes sense to look for a structure that fits more neatly into a disk block.

Hence the B+-tree, in which each node stores up to d references to children and up to $d - 1$ keys. Each reference is considered “between” two of the node's keys; it references the root of a subtree for which all values are between these two keys.

166. Insertion algorithm

Descend to the leaf where the key fits.

1. If the node has an empty space, insert the key/reference pair into the node.
2. If the node is already full, split it into two nodes, distributing the keys evenly between the two nodes. If the node is a leaf, take a copy of the minimum value in the second of these two nodes and repeat this insertion algorithm to insert it into the parent node. If the node is a non-leaf, exclude the middle value during the split and repeat this insertion algorithm to insert this excluded value into the parent node.

167. The level of aggregation of information required for operational control is = **Detailed**

168. In a Hierarchical database, a hashing function is used to locate the = **Root**

169. Which are the two modes of IP security = **Transport and tunnel**

170. Which are the two modes of IP security=**Transport and tunnel**

171. Which is dense index = **Secondary index**
[Dense index: In a dense index, an index entry appears for every search-key value in the file. In a dense clustering index, the index record contains the search-key value and a pointer to the first data record with that search-key value. It is also a secondary index.]
172. Aliasing in the context of programming languages refers to = **multiple variables having the same memory location**
173. The- results returned by functions under value-result and reference parameter passing conventions = **May differ in the presence of exceptions**
174. **Pass by Value:** In this parameter passing method, values of actual parameters are copied to function's formal parameters and the two types of parameters are stored in different memory locations. So any changes made inside functions are not reflected in actual parameters of caller.
Pass by Reference Both actual and formal parameters refer to same locations, so any changes made inside the function are actually reflected in actual parameters of caller.
175. In the context of C data types = **"unsigned long long int" is a valid data type.**
176. For a given integer, which of the following operators can be used to "set" and "reset" a particular bit respective = **| and &**
177. Which functions from "stdio.h" can be used in place of **printf()** = **fprintf() with FILE stream as stdout.**
178. As per C language standard = **make main elseif are valid keywords.**
179. Which of the following statement is correct for **switch** controlling expression = **Both int and char can be used in "switch" control expression.**
180. In the context of "**break**" and "**continue**" statements in C, pick the best statement = **"break" and "continue" can be used in "for", "while" and "do-while" loop body. But only "break" can be used in "switch" body.**
181. The following is correct with respect to "Jump Statements" in C = **goto, continue, break, return**
182. "typedef" in C basically works as an alias. Which of the following is correct for "typedef" = **typedef can be used to alias compound data types such as struct and union, typedef can be used to alias both compound data types and pointer to these compound types, typedef can be used to alias a function pointer, typedef can be used to alias an array.**
183. Which is correct for a function definition along with storage-class specifier in C language = **int fun(register int arg)**

184. Is the following statement a declaration or definition `extern int i;` = **Declaration**
185. Which is executed by Pre-process = **`#include<stdio.h>`**
186. How many loops are there in C = **C Language has only three loops - for, while, do while**
187. When C Language was invented = **1972**
[Dennis MacAlistair Ritchie was an American computer scientist. He created the C programming language and, with long-time colleague Ken Thompson.]
188. What is the meaning of `void sum (int, int);` = **sum is a function which takes two int arguments and returns void**
189. The concept of two functions with same name is known as = **Function Overloading**
190. Libray function `getch()` belongs to which header file = **`conio.h`**
191. Which gcc flag is used to enable all Compiler warnings = **`gcc -Wall`**
192. Which gcc flag is used to generate maximum debug information = **`gcc -g3`**
193. Which command is to compile C code without linking using gcc compiler = **`gcc -c cppbuzz.c`**
194. Which macro is used to insert assembly code in C program (VC++ compiler) = **`__asm`**
195. Which macro is used to insert assembly code in C program = **`__asm__`**
196. Which gcc option is used to generate assembly code from C code on Linux = **`-S`**
197. What is the job of Assembler in C programming = **It converts a assembly language program into machine language**
198. Will compiler produce any compilation error if same header file is included two times = **No**
199. Which of the following ways are correct to comment out preprocessing of any line = **`// #include<stdio.h>`**
200. Which of the following ways can be used to include header file in C programs = **`#include<stdio.h>`, `#include"stdio.h"`**
201. What is the extension of output file produced by Pre processor= **`.i`**
202. Which compilation unit is responsible for adding header files content in the source code = **Pre-processor**

203. In compilation process at what sequence Pre-processor comes into picture = 1
204. What is the Latest Version of C Language = C11
205. The ASCII code of '0' (zero) is = 48D
206. #include is called = Pre-processor directive
207. Function fopen() with the mode "r+" tries to open the file for = reading and writing
208. A local variable is stored in = Stack segment
209. Which standard library function can return a pointer to the last occurrence of a character in a string = strrchr()
210. Pre-processor feature that supply line numbers and file names to compiler is called = Line control
211. Using = if statement is how you test for a specific condition.
212. If you want to store dissimilar data together, then which type you will use = structure
213. What is the default return-type of getchar() = int
214. Which cannot be checked in a switch-case statement = Float
215. The function that calls itself for its processing is known as = Recursive Function
216. Array index always start from = 0
217. A transparent DBMS = Keeps its physical structure hidden from users
218. How can one convert numbers to strings = Using sprintf()
219. What is the purpose of fflush() function = flushes all streams and specified streams.
220. What function should be used to free the memory allocated by calloc() = free();
221. Which header file should be included to use functions like malloc() and calloc() = stdlib.h
222. Which is not a storage class = Struct
223. Queue can be used to implement = Radix sort

224. To use the function tolower(), which of the following header file should be used = **ctype.h**
225. A pointer in c which has not been initialized is known as = **wild pointer**
226. The default parameter passing mechanism is called as = **call by reference**
227. Which of the following is correct about structure in c++ = **structure does not support inheritance but class supports, class data members are private by default while structures are public by default, structure cannot be declared as abstract.**
228. The C language is = **A context sensitive language**
229. Which operation can be applied to pointer variable = **Addition.**
230. Which of the following operation can be applied to pointer variable = **Addition.**
231. Recursive functions are executed in a = **LIFO order**
232. Which are associated with objects = **State, Behaviour, Identity**
233. **A publicly derived class is a subtype of its base class, Inheritance provides for code reuse.**
234. The feature in object-oriented programming that allows the same operation to be carried out differently, depending on the object, is = **Polymorphism**
235. Differentiate between overloaded functions and overridden functions = **Overloading is a static or compile time binding and overriding is dynamic or runtime binding.**
236. Converting a primitive type data into its corresponding wrapper class object instance is called = **Autoboxing**
237. What is the difference between struct and class in C++ = **Members of a class are private by default and members of struct are public by default. When deriving a struct from a class/struct, default access-specifier for a base class/struct is public and when deriving a class, default access specifier is private.**
238. A member function can always access the data in(C++) = **the class of which it is member**
239. virtual function in C++ = **Must be declared in public section of class, Virtual function should be accessed using pointers, Virtual function is defined in base class.**
240. Which of the following cannot be passed to a function in C++ = **Header file**
241. Which is in C++, is inherited in a derived class from base class = **data members**

242. Which of the followings is/are automatically added to every class, if we do not write our own = **Copy Constructor, Assignment Operator, A constructor without any parameter**
243. a copy constructor may be called = **When an object of the class is returned by value, When an object of the class is passed (to a function) by value as an argument, When an object is constructed based on another object of the same class, When compiler generates a temporary object.**
244. We must use initializer list in a constructor when = **There is a reference variable in class, There is a constant variable in class, There is an object of another class. And the other class doesn't have default constructor.**
245. Implicit return type of a class constructor is = **class type itself**
246. What is the right way to declare a copy constructor of a class if the name of the class is MyClass = **MyClass (constant MyClass &arg)**
247. The explicit keyword is an optional decoration for the constructors that takes exactly = **one argument**
248. A class can contain objects of other classes and this phenomenon is called = **Containership**
249. If a class contains pure virtual function, then it is termed as = **Abstract Class**
250. If inner catch handler is not able to handle the exception then = **Compiler will check for appropriate catch handler of outer try block**
251. Suitable syntax for function template = **template< class T> return_type Function_Name(parameters) , template< typename T> return_type Function_Name(parameters)**
252. A thread is usually defined as a “light weight process” because an operating system (OS) maintains smaller data structures for a thread than for a process = **On per-thread basis, the OS does not maintain virtual memory state**
253. Which does not interrupt a running process = **Scheduler process**
254. Which need not necessarily be saved on a context switch between processes = **Translation look aside buffer**
255. An operating system implements a policy that requires a process to release all resources before making a request for another resource = **Starvation can occur but deadlock cannot occur**
256. If the time-slice used in the round-robin scheduling policy is more than the maximum time required to execute any process, then the policy will = **degenerate to first come first serve**

257. Which process scheduling algorithm may lead to starvation = **Shortest Job Next**
258. If the quantum time of round robin algorithm is very large, then it is equivalent to = **First in first out**
259. Which scheduling algorithms is non-preemptive = **First-In First-Out**
260. The maximum number of processes that can be in Ready state for a computer system with n CPUs is = **Independent of n**
261. **The most optimal scheduling algorithm is :** For each specific problem, the efficient algorithms could be different ones. Hence, the most optimal algorithm can't be determined.
262. The time taken to switch between user and kernel modes of execution be t1 while the time taken to switch between two processes be t2 = **t1 < t2**
263. A thread is usually defined as a "light weight process" because an operating system (OS) maintains smaller data structures for a thread than for a process = **On per-thread basis, the OS does not maintain virtual memory state**
264. Which is not necessarily be saved on a context switch between processes = **Translation look aside buffer**
265. Two atomic operations permissible on Semaphores are = **wait, signal**
266. The Bounded buffer problem is also known = **Producer – consumer problem**
267. deadlock prevention and deadlock avoidance schemes = **In deadlock avoidance, the request for resources is always granted if the result state is safe, Deadlock avoidance is less restrictive than deadlock prevention, Deadlock avoidance requires knowledge of resource requirements a priori**
268. A system contains three programs and each requires three tape units for its operation. The minimum number of tape units which the system must have such that deadlocks never arise is = **7**
269. What problem is solved by Dijkstra banker's algorithm = **Deadlock avoidance**
270. **There are 4 conditions required for a deadlock to occur:**
- 1) **Mutual Exclusion**
 - 2) **No pre-emption**
 - 3) **Hold and wait**
 - 4) **Circular wait**
271. When a process is rolled back as a result of deadlock the difficulty which arises is = **Starvation**

272. Which] page replacement algorithms suffers from Belady’s anomaly = **FIFO**
273. What is the swap space in the disk used for = **Saving process data**
274. Increasing the RAM of a computer typically improves performance because = **Fewer page faults occur**
275. A CPU generates 32-bit virtual addresses. The page size is 4 KB. The processor has a translation look-aside buffer (TLB) which can hold a total of 128 page table entries and is 4-way set associative. The minimum size of the TLB tag is = **15 bits**
276. Virtual memory is = **Illusion of large main memory**
277. Page fault occurs when = **When a requested page is not in memory**
278. Thrashing occurs when = **Processes on system frequently access pages not memory**
279. In which one of the following page replacement policies, Belady’s anomaly may occur = **FIFO**
280. The essential content(s) in each entry of a page table is = **Page frame number**
281. A multilevel page table is preferred in comparison to a single level page table for translating virtual address to physical address because = **It helps to reduce the size of page table needed to implement the virtual address space of a process.**
282. Virtual memory is = **Illusion of large main memory**
283. A computer system supports 32-bit virtual addresses as well as 32-bit physical addresses. Since the virtual address space is of the same size as the physical address space, the operating system designers decide to get rid of the virtual memory entirely = **Hardware support for memory management is no longer needed**
284. **The shell command:**
`find -name passwd -print`
 is executed in /etc directory of a computer system running Unix. Which of the following shell commands will give the same information as the above command when executed in the same directory=`grep name passwd`
285. A user level process in Unix traps the signal sent on a Ctrl-C input, and has a signal handling routine that saves appropriate files before terminating the process. When a Ctrl-C input is given to this process, what is the mode in which the signal handling routine executes = **kernel mode**
286. The linux command “mknod myfifo b 4 16” = **Will create a block device if the user is root**

287. “init”(short for initialization) process in UNIX have:
1. process id (PID) = 1
 2. It is generally the parent of the login shell.
 3. “init” forks and execs a ‘getty’ process at every port connected to a terminal. But it is not the first process in the system
288. In UNIX, processes that have finished execution but have not yet had their status collected are known = **Zombie processes**
289. In Unix operating system, when a process creates a new process using the fork () system call, which of the following state is shared between the parent process and child process = **Shared memory segments**
290. In Unix, the login prompt can be changed by changing the contents of the file = **gettydefs**
291. The Unix Kernel maintains two key data structures related to processes, the process table and the user structure. Which of the following information is not the part of user structure = **Scheduling parameters**
292. In a sliding window ARQ scheme, the transmitter’s window size is N and the receiver’s window size is M. The minimum number of distinct sequence numbers required to ensure correct operation of the ARQ scheme is = **M + N**
293. Which protocol is NOT used to resolve one form of address to another one = **DHCP**
294. How many bytes of data can be sent in 15 seconds over a serial link with baud rate of 9600 in asynchronous mode with odd parity and two stop bits in the frame = **12,000 bytes**
295. Which protocol will be used to automate the IP configuration mechanism which includes IP address, subnet mask, default gateway, and DNS information = **DHCP**
296. Purpose of a start bit in R8232 serial communication protocol is = **to synchronize receiver for receiving every byte**
297. The transport layer protocols used for real time multimedia, file transfer, DNS and email, respectively are = **UDP, TCP, UDP and TCP**
298. Which transport layer protocols is used to support electronic mail = **TCP**
299. Which system calls results in the sending of SYN packets = **connect**
300. In the slow start phase of the TCP congestion control algorithm, the size of the congestion window = **increases exponentially**
301. Which uses UDP as the transport protocol = **DNS**

302. In Ethernet when Manchester encoding is used, the bit rate is = **Half the baud rate.**
303. The message 11001001 is to be transmitted using the CRC polynomial $x^3 + 1$ to protect it from errors. The message that should be transmitted is = **11001001011**
304. In serial data transmission, every byte of data is padded with a '0' in the beginning and one or two '1' s at the end of byte because = **Receiver is to be synchronized for byte reception**
305. In an Ethernet local area network = **The exponential backoff mechanism reduces the probability of collision on retransmissions**
306. An Ethernet frame that is less than the IEEE 802.3 minimum length of 64 octets is called = **Runt frame**
307. One of the header fields in an IP datagram is the Time to Live(TTL)field. -Which of the following statements best explains the need for this field = **It can be used to prevent packet looping**
308. For which one of the following reasons does Internet Protocol (IP) use the time to- live (TTL) field in the IP datagram header = **Prevent packets from looping indefinitely**
309. Which interior Gateway routing protocols – Routing Information Protocol (RIP) and Open Shortest Path First (OSPF) = **RIP uses distance vector routing and OSPF uses link state routing**
310. The address resolution protocol (ARP) is used for = **Finding the MAC address that corresponds to an IP address**
311. Routers forward a packet using forwarding table entries. The network address of incoming packet may match multiple entries. How routers resolve this = **Forward it the router whose entry matches with the longest prefix of incoming packet**
312. The protocol data unit (PDU) for the application layer in the Internet stack is = **Message**
313. What is the maximum size of data that the application layer can pass on to the TCP layer below = **Any size**
314. In one of the pairs of protocols given below, both the protocols can use multiple TCP connections between the same client and the server. Which one is that = **HTTP, FTP**
315. Which of the following protocol is used for transferring electronic mail messages from one machine to another = **SMTP**
316. A sender is employing public key cryptography to send a secret message to a receiver. Which one of the following statements is TRUE = **Sender encrypts using receiver's public key**

317. Anarkali digitally signs a message and sends it to Salim. Verification of the signature by Salim requires = **Anarkali's public key.**
318. MD5 is a widely used hash function for producing hash value of = **128 bits**
319. Pretty Good Privacy (PGP) is used in=An attacker sits between the sender and receiver and captures the information and retransmits to the receiver after some time without altering the information. This attack is called as = **Denial of service attack Email security**
320. Which encryption algorithms is based on the Fiestal structure = **Data Encryption Standard**
321. Onsider a join (relation algebra) between relations $r(R)$ and $s(S)$ using the nested loop method. There are 3 buffers each of size equal to disk block size, out of which one buffer is reserved for intermediate results. Assuming $\text{size}(r(R)) < \text{size}(s(S))$, the join will have fewer number of disk block accesses if = **relation $r(R)$ is in the outer loop.**
322. Which symbol denote derived attributes in ER Model = **Dashed ellipse**
323. Which one is correct w.r.t. RDBMS = **primary key \subseteq candidate key \subseteq super key**
324. Goals for the design of the logical scheme include = **avoiding data inconsistency, being able to construct query easily, being able to access data efficiently**
325. An aggregation association is drawn using which symbol = **A small open diamond at the end of a line connecting two tables**
326. If every non-key attribute is functionally dependent on the primary key, then the relation is in = **Second normal form**
327. Consider a schema $R(MNPQ)$ and functional dependencies $M \rightarrow N, P \rightarrow Q$. Then the decomposition of R into $R_1(MN)$ and $R_2(PQ)$ is = **Dependency preserving but not lossless join**
328. DBMS provides the facility of accessing data from a database through = **DML**
329. Consider a database table R with attributes A and B . Which of the following SQL queries is illegal = **SELECT A, COUNT(*) FROM R;**
330. In RDBMS, the constraint that no key attribute (column) may be NULL is referred to as = **Entity Integrity**
331. The statement that is executed automatically by the system as a side effect of the modification of the database is = **trigger**

332. Which of the following command is used to delete a table in SQL = **drop**
333. Select operation in SQL is equivalent to = **the projection operation in relational algebra, except that select in SQL retains duplicates**
334. In distributed databases, location transparency allows for database users, programmers and administrators to treat the data as if it is at one location. A SQL query with location transparency needs to specify = **Fragments**
335. An Assertion is a predicate expressing a condition we wish database to always satisfy. The correct syntax for Assertion is = **CREATE ASSERTION 'ASSERTION Name' CHECK 'Predicate'**
336. In propositional logic if $(P \rightarrow Q) \wedge (R \rightarrow S)$ and $(P \vee R)$ are two premises such that
 $(P \rightarrow Q) \wedge (R \rightarrow S)$
 $P \vee R$
 Y
 Y is the premise = **$Q \vee S$**
337. ECL is the fastest of all logic families. High speed in ECL is possible because transistors are used in difference amplifier configuration, in which they are never driven into = **Saturation**
338. A horn clause is = **A clause that has at most one positive literal**
339. In Propositional Logic, given P and $P \rightarrow Q$, we can infer = **340**
340. Equivalent logical expression for the Well Formed Formula (WFF), $\sim(\forall x) F[x]$ = **$\exists x (\sim F[x])$**
341. The minterm expansion of $f(P, Q, R) = PQ + QR' + PR'$ is = **$m_2 + m_4 + m_6 + m_7$**
342. If P, Q, R are Boolean variables, then $(P + Q')(PQ' + PR)(P'R' + Q')$ simplifies = **PQ'**
343. The hexadecimal representation of 657_8 is = **1AF**
344. The addition of 4-bit, two's complement, binary numbers 1101 and 0100 results in = **0001 and no overflow**
345. Which input sequences for a cross-coupled R-S flip-flop realized with two NAND gates may lead to an = **00, 11**
346. The smallest integer that can be represented by an 8-bit number in 2's complement form is = **-128**
347. The decimal value 0.5 in IEEE single precision floating point representation has = **fraction bits of 000...000 and exponent value of -1**

348. In the IEEE floating point representation, the hexadecimal value 0×00000000 corresponds to = **the special value +0**
349. The decimal value 0.25 = **is equivalent to the binary value 0.01**
350. Sign extension is a step in = **converting a signed integer from one size to another**
351. The simplified SOP (Sum Of Product) form of the boolean expression $(P + Q' + R') \cdot (P + Q' + R) \cdot (P + Q + R')$ is = **$(P + Q' \cdot R')$**
352. The minterm expansion of $f(P, Q, R) = PQ + QR' + PR'$ is = **$m_2 + m_4 + m_6 + m_7$**
353. The Boolean expression $(A + C')(B' + C')$ simplifies to = **$C' + AB'$**
354. In the expression $A'(A' + B')$ by writing the first term A as $A + 0$, the expression is best simplified as = **A'**
355. Which is termed as minimum error code = **Gray code**
356. In 8085, which are modifies the program counter =
(A) Only PCHL instruction
(B) Only ADD instructions
(C) Only JMP and CALL instructions
357. In the absolute addressing mode = **the address of the operand is inside the instruction**
358. Horizontal microprogramming :
(A) does not require use of signal decoders
(B) results in larger sized microinstructions than vertical microprogramming
(C) uses one bit for each control signal
359. A low memory can be connected to 8085 by using = **READY**
360. A processor needs software interrupt to = **obtain system services which need execution of privileged instructions**
361. Why to use fflush() library function = **To flush all streams and specified streams**
362. Why is calloc() function used for = **allocates the specified number of bytes and initializes them to zero**
363. The correct sequence of compilation process = **Preprocessor → Compiler → Assembler → Linking**
364. The lexical analysis for a modern computer language such as Java needs the power of which one of the following machine models in a necessary and sufficient sense = **Finite state automata**

365. Which one of the following statements is TRUE
 (A) Context-free grammar can be used to specify both lexical and syntax rules.
 (B) High-level language programs can be translated to different Intermediate Representations.
 (C) Arguments to a function can be passed using the program stack.
366. The output of a lexical analyzer is = **A stream of tokens**
367. The number of tokens in the following C statement is `printf("i=%d, &i=%x", i&i);` = **9**
368. Debugger is a program that = **allows to set breakpoints, execute a segment of program and display contents of register**
369. The grammar $S \rightarrow aSa \mid bS \mid c$ is =
 (A) **LL(1) but not LR(1)**
 (B) **LR(1) but not LR(1)**
370. Which describes a handle (as applicable to LR-parsing) appropriately? It is the production = **p that will be used for reduction in the next step along with a position in the sentential form where the right hand side of the production may be found**
371. An LALR(1) parser for a grammar G can have shift-reduce (S-R) conflicts if and only if = **the LR(1) parser for G has S-R conflicts**
372. Which is a top-down parser = **Recursive descent parser**
373. The grammar $A \rightarrow AA \mid (A) \mid \epsilon$ is not suitable for predictive-parsing because the grammar is = **ambiguous**
374. In a bottom-up evaluation of a syntax directed definition, inherited attributes can = **be evaluated only if the definition is L-attributed**
375. Which is the most powerful parsing method = **Canonical LR**
376. Which does a top-down parser use while parsing an input string? The input is assumed to be scanned in left to right order = **Leftmost derivation**
377. The process of assigning load addresses to the various parts of the program and adjusting the code and data in the program to reflect the assigned addresses is = **Relocation**
378. Which of the following statements is true =
 a) **An LL(1) parser is a top-down parser**
 b) **LALR is more powerful than SLR**
 c) **An ambiguous grammar can never be LR(k) for any k**

379. Consider a program P that consists of two source modules M1 and M2 contained in two different files. If M1 contains a reference to a function defined in M2 the reference will be resolved at = **Link time**
380. Assume that the SLR parser for a grammar G has n1 states and the LALR parser for G has n2 states. The relationship between n1 and n2 is = **n1 is necessarily equal to n2**
381. Some code optimizations are carried out on the intermediate code because = **they enhance the portability of the compiler to other target processors**
382. One of the purposes of using intermediate code in compilers is to = **increase the chances of reusing the machine-independent code optimizer in other compilers.**
383. A grammar that is both left and right recursive for a non-terminal is = **Information is not sufficient to decide whether it is ambiguous or Unambiguous.**
384. In a resident- OS computer, which system software must reside in the main memory under all situations = **Loader**
385. The condition expansion facility of macro processors is provided = **to expand certain model statements depending upon the value of a condition during the process of macros expansion**
386. Which one of the following is NOT desired in a good Software Requirement Specifications (SRS) document = **Algorithms for Software Implementation**
387. Which one of the following is TRUE = **Prototyping is a method of requirements validation**
388. In the context of modular software design, which combinations is desirable = **High cohesion and low coupling**
389. A Software Requirements Specification (SRS) document should avoid discussing which one of the following = **Design specification**
390. In a software project, COCOMO (Constructive Cost Model) is used to estimate = **effort and duration based on the size of the software**
391. An XML document that adheres to syntax rules specified by XML 1.0 specification in that it must satisfy both physical and logical structured, is called = **Well – formed**
392. Statistical software quality assurance in software engineering involves = **tracing each defect to its underlying cause, isolating the vital few causes, and moving to correct them.**
393. A signal processor software is expected to operate for 91.25 days after repair, and the mean software repair time is expected to be 5 minutes. Then, the availability of the software is = **99.9962%**

394. In Artificial Intelligence (AI), which agent deals with happy and unhappy state = **Utility based agent**
395. The ISO quality assurance standard that applies to software Engineering is = **ISO 9000 : 2004**
396. Which is external qualities of a software product = **Correctness, reliability, robustness, efficiency, usability.**
397. For a software project, the spiral model was employed. When will the spiral stop = **When the software product is retired**
398. The extent to which a software tolerates the unexpected problems, is termed as = **Robustness**
399. Software safety is quality assurance activity that focuses on hazards that = **may cause an entire system to fail.**
400. A software program that infers and manipulates existing knowledge in order to generate new knowledge is known as = **Inference engine**
401. What is the cyclomatic complexity of a module which has seventeen edges and thirteen nodes=**6**
402. Which type of coupling has the weakest coupling = **Data coupling**
403. Black Box Software Testing method focuses on the = **Functional requirement of the software**
404. As compared to rental and leasing methods to acquire computer systems for a Management Information System (MIS), purchase method has following advantage = **It is a business investment**
405. Warnier Diagram enables the analyst to represent = **Information Hierarchy**
406. What is recurrence for worst case of Quick Sort and what is the time complexity in Worst case=Recurrence is $T(n) = T(n-1) + O(n)$ and time complexity is $O(n^2)$
407. Given an unsorted array. The array has this property that every element in array is at most k distance from its position in sorted array where k is a positive integer smaller than size of array. Which sorting algorithm can be easily modified for sorting this array and what is the obtainable time complexity = **Heap Sort with time complexity $O(n \log k)$**
408. The recurrence relation capturing the optimal time of the Tower of Hanoi problem with n discs is = **$T(n) = 2T(n - 1) + 1$**
409. Which of the following is not $O(n^2)$ = **$n^3 / (\sqrt{n})$**

410. What is the best time complexity of bubble sort = N
411. What is the worst case time complexity of insertion sort where position of the data to be inserted is calculated using binary search = N^2
412. The tightest lower bound on the number of comparisons, in the worst case, for comparison-based sorting is of the order of = $N \log N$
413. A list of n string, each of length n , is sorted into lexicographic order using the merge-sort algorithm. The worst case running time of this computation is = $O(n^2 \log n)$
414. Which of the following sorting algorithms has the lowest worst-case complexity = **Merge Sort**
415. What is the size of the smallest MIS(Maximal Independent Set) of a chain of nine nodes = **3**
416. What is the value of following recurrence.
 $T(n) = 5T(n/5) + \quad ,$
 $T(1) = 1,$
 $T(0) = 0$
 = **$\Theta(n)$**
417. The solution to the recurrence equation $T(2^k) = 3 T(2^{k-1}) + 1, T(1) = 1$, is = **$(3^{k+1} - 1)/2$**
418. Consider the recurrence relation $a_1 = 8, a_n = 6n^2 + 2n + a_{n-1}$. Let $a_{99} = k \times 10^4$. The value of K is = **198**
419. When $n = 2^{2k}$ for some $k \geq 0$, the recurrence relation
 $T(n) = \sqrt{2} T(n/2) + \sqrt{n}, T(1) = 1$
 evaluates to = **$\sqrt{n} (\log n + 1)$**
420. Standard planning algorithms assume environment to be = **Both deterministic and fully observable**
421. Consider the following recurrence:
 $T(n) = 2T(n^{1/2}) + 1$
 $T(1) = 1$
 = $T(n) =$ **$O(\log n)$**

422. What is the time complexity for the following C module? Assume that $n > 0$.
- ```
int module(int n)
{
if (n == 1)
return 1;
else
return (n + module(n-1));
}
=O(n)
```
423. Which of the following algorithms is NOT a divide & conquer algorithm by nature = **Heap Sort**
424. Consider the polynomial  $p(x) = a_0 + a_1x + a_2x^2 + a_3x^3$ , where  $a_i \neq 0$ , for all  $i$ . The minimum number of multiplications needed to evaluate  $p$  on an input  $x$  is = **3**
425. Consider the problem of computing min-max in an unsorted array where min and max are minimum and maximum elements of array. Algorithm A1 can compute min-max in  $a_1$  comparisons without divide and conquer. Algorithm A2 can compute min-max in  $a_2$  comparisons by scanning the array linearly. What could be the relation between  $a_1$  and  $a_2$  considering the worst case scenarios = **Depends on the input**
426. Consider the problem of searching an element  $x$  in an array 'arr[]' of size  $n$ . The problem can be solved in  $O(\text{Log}n)$  time if.=
- 1) **Array is sorted**
  - 2) **Array is sorted and rotated by  $k$ .  $k$  is given to you and  $k \leq n$**
  - 3) **Array is sorted and rotated by  $k$ .  $k$  is NOT given to you and  $k \leq n$**
427. Consider a situation where you don't have function to calculate power ( $\text{pow}()$  function in C) and you need to calculate  $x^n$  where  $x$  can be any number and  $n$  is a positive integer. What can be the best possible time complexity of your power function =  **$O(\text{Log}n)$**
428. Maximum Subarray Sum problem is to find the subarray with maximum sum. For example, given an array {12, -13, -5, 25, -20, 30, 10}, the maximum subarray sum is = **45**.
429. Which of the following is not a stable sorting algorithm in its typical implementation = **Quick Sort**
430. Consider a situation where swap operation is very costly. Which of the following sorting algorithms should be preferred so that the number of swap operations are minimized in general = **Selection Sort**
431. You have to sort 1 GB of data with only 100 MB of available main memory. Which sorting technique will be most appropriate = **Merge sort**
432. In a modified merge sort, the input array is splitted at a position one-third of the length( $N$ ) of the array. Which of the following is the tightest upper bound on time complexity of this modified Merge Sort =  **$N(\text{log}N \text{ base } 3/2)$**



433. Which sorting algorithm will take least time when all elements of input array are identical? Consider typical implementations of sorting algorithms = **Insertion Sort**
434. A list of  $n$  string, each of length  $n$ , is sorted into lexicographic order using the merge-sort algorithm. The worst case running time of this computation is =  **$O(n^2 \log n)$**
435. Which of the following sorting algorithms has the lowest worst-case complexity = **Merge Sort**
436. Which of the following is true about merge sort=  
**(A) Merge Sort works better than quick sort if data is accessed from slow sequential memory.**  
**(B) Merge Sort is stable sort by nature**  
**(C) Merge sort outperforms heap sort in most of the practical situations.**
437. What is the best sorting algorithm to use for the elements in array are more than 1 million in general = **Quick sort.**
438. Given two sorted list of size  $m$  and  $n$  respectively. The number of comparisons needed the worst case by the merge sort algorithm will be =  **$m + n - 1$**
439. Of the following sorting algorithms, which has a running time that is least dependent on the initial ordering of the input = **Merge Sort**
440. Which of the following standard algorithms is not a Greedy algorithm = **Bellmen Ford Shortest path algorithm**
441. What is the time complexity of Huffman Coding =  **$O(N \log N)$**
442. In question #2, which of the following represents the word "dead"=  
**(A) 1011111100101**  
**(B) 0100000011010**
443. Which of the following is true about Kruskal and Prim MST algorithms? Assume that Prim is implemented for adjacency list representation using Binary Heap and Kruskal is implemented using union by rank = **Worst case time complexity of both algorithms is same.**
444. Which of the following is true about Huffman Coding = **In Huffman coding, no code is prefix of any other code.**
445. To implement Dijkstra's shortest path algorithm on unweighted graphs so that it runs in linear time, the data structure to be used is = **Queue**
446. In an unweighted, undirected connected graph, the shortest path from a node  $S$  to every other node is computed most efficiently, in terms of time complexity by = **Performing a BFS starting from  $S$ .**

447. Which of the following algorithm can be used to **efficiently** calculate single source shortest paths in a Directed Acyclic Graph = **Topological Sort**
448. Given a directed graph where weight of every edge is same, we can efficiently find shortest path from a given source to destination using = **Breadth First Traversal**
449. The Floyd-Warshall algorithm for all-pair shortest paths computation is based on = **Dynamic Programming paradigm.**
450. Which of the following data structure is useful in traversing a given graph by breadth first search = **Queue**
451. Which of the following algorithm solves the all-pair shortest path problem = **Floyd-Warshall's algorithm**
452. Which one of the following algorithm design techniques is used in finding all pairs of shortest distances in a graph = **Dynamic programming**
453. The length of the path from v5 to v6 in the MST of previous question with n = 10 is = **31**
454. In the graph given in above question question, what is the minimum possible weight of a path P from vertex 1 to vertex 2 in this graph such that P contains at most 3 edges = **8**
455. Let G be an undirected connected graph with distinct edge weight. Let  $e_{max}$  be the edge with maximum weight and  $e_{min}$  the edge with minimum weight. Which of the following statements is false = **No minimum spanning tree contains  $e_{max}$**
456. What is the largest integer m such that every simple connected graph with n vertices and n edges contains at least m different spanning trees = **3**
457. Which of the following standard algorithms is not Dynamic Programming based = **Prim's Minimum Spanning Tree**
458. We use dynamic programming approach when = **The solution has optimal substructure**
459. Kadane algorithm is used to find = **Maximum sum subarray in an array**
460. The following paradigm can be used to find the solution of the problem in minimum time:  
Given a set of non-negative integer, and a value K, determine if there is a subset of the given set with sum equal to K = **Dynamic Programming**
461. Which of the following is not a backtracking algorithm = **Tower of Hanoi**
462. Which of the following is correct recurrence for worst case of Binary Search =  **$T(n) = T(n/2) + O(1)$  and  $T(1) = T(0) = O(1)$**

463. In the above question, the correction needed in the program to make it work properly is = **Change line 6 to: if (Y[k] < x) i = k + 1; else j = k-1;**
464. The average number of key comparisons done in a successful sequential search in a list of length it is = **(n+1)/2**
465. The recurrence relation that arises in relation with the complexity of binary search is =  **$T(n) = T(n/2) + k$ , where k is constant**
466. The average number of key comparisons required for a successful search for sequential search on items is = **(n+1)/2**
467. Suppose there are 11 items in sorted order in an array. How many searches are required on the average, if binary search is employed and all searches are successful in finding the item = **3.00**
468. The average case occurs in the Linear Search Algorithm when = **The item to be searched is in some where middle of the Array**
469. Number of comparisons required for an unsuccessful search of an element in a sequential search, organized, fixed length, symbol table of length L is = **L**
470. Which of the following statements is true for Branch – and – Bound search = **Dynamic programming principle can be used to discard redundant partial paths.**
471. What is recurrence for worst case of QuickSort and what is the time complexity in Worst case=Recurrence is  **$T(n) = T(n-1) + O(n)$  and time complexity is  $O(n^2)$**
472. Which of the following is not a stable sorting algorithm in its typical implementation = **Quick Sort**
473. Which of the following sorting algorithms in its typical implementation gives best performance when applied on an array which is sorted or almost sorted = **Insertion Sort**
474. Given an unsorted array. The array has this property that every element in array is at most k distance from its position in sorted array where k is a positive integer smaller than size of array. Which sorting algorithm can be easily modified for sorting this array and what is the obtainable time complexity = **Heap Sort with time complexity  $O(n \log k)$**
475. Consider a situation where swap operation is very costly. Which of the following sorting algorithms should be preferred so that the number of swap operations are minimized in general = **Selection Sort**
476. Assuming  $P \neq NP$ , which of the following is true =NP-complete = **NP**

477. The problem 3-SAT and 2-SAT are = **NP-complete and in P respectively**
478. Ram and Shyam have been asked to show that a certain problem  $\Pi$  is NP-complete. Ram shows a polynomial time reduction from the 3-SAT problem to  $\Pi$ , and Shyam shows a polynomial time reduction from  $\Pi$  to 3-SAT. Which of the following can be inferred from these reductions =  **$\Pi$  is NP-complete**
479. Consider two decision problems Q1, Q2 such that Q1 reduces in polynomial time to 3-SAT and 3-SAT reduces in polynomial time to Q2. Then which one of the following is consistent with the above statement = **Q1 is in NP, Q2 is NP hard**
480. A problem in NP is NP-complete if = **The 3-SAT problem can be reduced to it in polynomial time**
481. The problems 3-SAT and 2-SAT are = **NP-complete and in P, respectively**
482. HTML(Hypertext Markup Language) has language elements which permit certain actions other than describing the structure of the web document. Which one of the following actions is NOT supported by pure HTML pages = **Display the client time as part of the page**
483. Which of the following is an advantage of putting presentation information in a separate CSS file rather than in HTML itself =  
**(A) The content becomes easy to manage**  
**(B) Becomes easy to make site for different devices like mobile by making separate CSS files**  
**(C) CSS Files are generally cached and therefore decrease server load and network traffic.**
484. Consider the three commands : PROMPT, HEAD and RCPT.  
 Which of the following options indicate a correct association of these commands with protocols where these are used = **FTP, HTTP, SMTP**
485. A HTML form is to be designed to enable purchase of office stationery. Required items are to be selected (checked). Credit card details are to be entered and then the submit button is to be pressed. Which one of the following options would be appropriate for sending the data to the server. Assume that security is handled in a way that is transparent to the form design = **Only POST**
486. Which of the following statements is/are TRUE regarding Java = **A class can only inherit one class but can implement multiple interfaces.**
487. Type IV JDBC driver is a driver = **which communicates through Java sockets**
488. What is the use of final keyword in Java?  
**(A) When a class is made final, a subclass of it can not be created.**  
**(B) When a method is final, it can not be overridden.**  
**(C) When a variable is final, it can be assigned value only once.**
489. Which of the following is not an operator in Java = **sizeof**

490. Which of these is a super class of all errors and exceptions in the Java language = **Throwable**
491. The built-in base class in Java, which is used to handle all exceptions is = **Throwable**
492. Which of the following is/are advantages of packages?  
**(A) Packages avoid name clashes**  
**(B) Classes, even though they are visible outside their package, can have fields visible to packages only**  
**(C) We can have hidden classes that are used by the packages, but not visible outside.**
493. Which one of the following is correct = **Applets are embedded in another applications**
494. Which of the following is major part of time taken when accessing data on the disk = **Seek time**
495. From amongst the following given scenarios determine the right one to justify interrupt mode of data-transfer: = **Short events like mouse action,Key board inputs**
496. Normally user programs are prevented from handling I/O directly by I/O instructions in them. For CPUs having explicit I/O instructions, such I/O protection is ensured by having the I/O instructions privileged. In a CPU with memory mapped I/O, there is no explicit I/O instruction. Which one of the following is true for a CPU with memory mapped I/O = **I/O protection is ensured by operating system routine(s)**
497. Put the following disk scheduling policies results in minimum amount of head movement. = **Elevator**
498. Which of the following can be used as both Source and Destination IP = **10.0.0.1**  
**[Explanation: 192.168.1.255 is a Direct Broadcast Address (DBA), DBA can't be used as Source Address.**  
**127.0.0.1 Loopback address again can't be used as the source address.**  
**255.255.255.255 is Limited Broadcast Address, which cannot be used as DBA.]**
499. In the IPv4 addressing format, the number of networks allowed under Class C addresses is = **2<sup>21</sup>**
500. Which are the two modes of IP security = **Transport and tunnel**