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CSC 304

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PART 1

1. the goal or objective of computability theory is to determine which problems or kinds of problems, can be solved in each model of computation.

WHILE

The complexity of a problem or the objective of complexity theory is to describe whether a problem can be solved using algorithms

2. Computability theory deals primarily with the question of whether a problem is solvable at all on a computer. The statement that the halting problem cannot be solved by a Turing machine is one of the most important results in computability theory, as it is an example of a concrete problem that is both easy to formulate and impossible to solve using a Turing machine. Much of computability theory builds on the halting problem result.

Complexity Theory is part of the theory of computation dealing with the resources required during computation to solve a given problem. The most common resources are time (how many steps does it take to solve a problem) and space (how much memory does it take to solve a problem). Other resources can also be considered, such as how many parallel processors are needed to solve a problem in parallel. Complexity theory differs from computability theory, which deals with whether a problem can be solved at all, regardless of the resources required.

3. A set is a group or collection of objects or numbers, considered as an entity unto itself. Examples include the set of all computers in the world, the set of all apples on a tree, and the set of all irrational numbers between 0 and 1.

(ii)  *power set* of any *set* S is the *set* of all subsets of S, including the empty *set* and S itself, variously denoted as P(S), 𝒫(S). Eg If *S* is the set {*x*, *y*, *z*}, then the subsets of *S* are

* {}
* {*x*}
* {*y*}
* {*z*}
* {*x*, *y*}
* {*x*, *z*}
* {*y*, *z*}
* {*x*, *y*, *z*}

and hence the power set of *S* is {{}, {*x*}, {*y*}, {*z*}, {*x*, *y*}, {*x*, *z*}, {*y*, *z*}, {*x*, *y*, *z*}}

(iii) members of a set: elements that makes up a set. For example, {x,y,z} are the elements in set S.

(iv) Subset: is a set A is a subset of a set B, or equivalently B is a superset of A, if A is contained in B. That is, all elements of A are also elements of B. A and B may be equal.

(v) Proper subset : A proper subset of a set A is a subset of A that is not equal to A. In other words, if B is a proper subset of A, then all elements of B are in A but A contains at least one element that is not in B.

(vi) Infinite set:  set is said to be an infinite set whose elements cannot be listed if it has an unlimited (i.e. uncountable) by the natural number 1, 2, 3, 4, ………… n.

(vii) Finite set: a finite set is a set that has a finite number of elements. Informally, a finite set is a set which one could in principle count and finish counting.

(viii) Unordered pair:  is a set of the form {a, b}, i.e. a set having two elements a and b with no particular relation between them.

(ix) Union of a set: The union of two sets A and B is the set of elements which are in A, in B, or in both A and B.For example, if A = {1, 3, 5, 7} and B = {1, 2, 4, 6, 7} then A ∪ B = {1, 2, 3, 4, 5, 6, 7}.

(x) Intersection of a set:  intersection of two [sets](https://en.wikipedia.org/wiki/Set_%28mathematics%29) *A* and *B*, denoted by *A* ∩ *B*, is the set containing all elements of *A* that also belong to *B* (or equivalently, all elements of *B* that also belong to *A*). For example, The intersection of the sets {1, 2, 3} and {2, 3, 4} is {2, 3}.

(xi) Complement of a set: refers to elements not in A. When all sets under consideration are considered to be subsets of a given set U, the absolute complement of A is the set of elements in U but not in A.

(xii) Difference of a set: The difference of two sets, written A - B is the set of all elements of A that are not elements of B. The difference operation, along with union and intersection, is an important and fundamental set theory operation.

(xiii) Symmetric difference of a set :  is the set of elements which are in either of the sets and not in their intersection.

4.  

5. An alphabet is a [finite](https://simple.wikipedia.org/wiki/Finite_set) [non-empty](https://simple.wikipedia.org/wiki/Empty_set) [set](https://simple.wikipedia.org/wiki/Set). The [elements](https://simple.wikipedia.org/wiki/Element) of an alphabet are called the letters or symbols of the alphabet.

(ii) Words:

(iii) Length of words: Length of a word is denoted as |w| and is defined as the number of positions for the symbol in the string.

(iv) Substring:substring is a contiguous sequence of characters within a string.

(v) Initial segment:

(vi) Concatenation of strings:
Let w1 and w2 be two strings then w1w2 denotes their concatenation w. The concatenation is formed by making a copy of w1 and followed by a copy of w2.
For example w1 = xyz, w2 = uvw
then w = w1w2 = xyzuvw

(vii) Language: A language is a set of strings, chosen from some Σ\* or we can say- ‘A language is a subset of Σ\* ‘. A language which can be formed over ‘ Σ ‘ can be Finite or Infinite.

6. A = {a,c,e,i,o,n,t}

 v = concatenation

 u = catetioncona

(i) the length of v= 13

(ii) reverse string u= anocnoitetac

(iii) concatenate v and u= concatenationcatetioncona

(iv) substring of m if m=cacontatione

∑0={λ}

∑1= { c,a,c,o,n,t,a,t,I,o,n,e}

∑2= {ca,ac,co,on,nt,ta,at,ti,io,on,ne}

∑3= {cac,aco,con,,ont,tat,tio,ion,one}

∑4={caco,acon,cont,onta,tati,atio,ione}

∑5={cacon,acont,conta,ontat,ntati,tatio,ation,tione}

∑6={cacont,aconta,contat,ontati,ntatio,tation,atione}

∑7={caconta,acontat,contati,ontatio,ntation,tatione}

∑8={cacontat,acontati,contatio,notation,ntatione}

∑9={cacontati,acontatio,contation,ontatione,}

∑10={cacontatio,acontation,contatione}

∑11={cacontation,acontatione}

∑12={cacomtatione}

7. substring of s={abracaba}

(i) ∑0={λ}

∑1={a,b,r,a,c,a,b,a}

∑2={ab,br,ra,ca,ab,ba}

∑3={abr,bra,rac,aca,cab,aba}

∑4={abar,brac,raca,acab,caba}

∑5={abrac,braca,racab,acaba}

∑6={abraca,bracab,racaba}

∑7= {abracab,bracaba}

∑8={abracaba}

8&9. 

11. 

12. 

13. {b^n a^m b^p|n>0,m>=0,p>=0}

(ii) {b^n a b^m|n>0,m>=0}

(iii) { b^n|n>0}

(iv) {a^n b^m| n>0,m>0}

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