

DAA Assignment - 5

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CSE - COAE - II

1. A decision problem is a problem that can be posed as a yes-no question of input values. An ex. of decision problem is deciding whether or given natural no is prime. Another is the problem "given two number x and y , does x evenly divides y "? The ans is either "yes" or "no" depending upon the values of x and y . A method for solving a decision problem, gives in the form of algorithm, is called a decision procedure for that problem.

A decision algorithm for a decision problem "given two no's x and y , does x evenly divides y ?" would give the steps for determining whether x evenly divides y .

One such algorithm is long division. If the remainder is zero then answer is 'yes', otherwise it is 'no'. A decision problem which can be solved by an algorithm is called decidable.

2. Optimization algorithm is a procedure which is executed iteratively by comparing various till an optimum or satisfactory solution is found.

Types of optimization problem:-

- Continuous v/s Discrete optimization.

Some models only make sense if the variables on values from a discrete set, often a subset of integers, whereas other models contain variable that can take on real value.

- Unconstraint v/s constraint optimization.

Another important distinction is b/w problem in which there are no constraints on the variable and problems in which there are constraint on the variables. Unconstraint problem arise directly in many practical applicables. They also arise in the reformulation of constraints optimization problem in which the constraints are replaced by a penalty term in objective function.

- Deterministic v/s Stochastic optimization.

In deterministic, it is assumed that data for the given problem are known accurately.

In optimization under uncertainty, or stochastic optimization, the uncertainty is incorporated into model.

3. Polynomial Running Time.

An algorithm is said to be solvable in polynomial time if no. of steps required to complete the algorithm for a given input $O(n^k)$ for some non-negative integer k , where n is the complexity. To the input, polynomial-time algorithms are said to be "fast". Most familiar mathematical problems such as addition, subtraction, multiplication & division, as well as computing square roots, power and logarithm, can be performed in polynomial time, computing the digit of most interesting mathematical constants, including π & e can also be done in polynomial time.

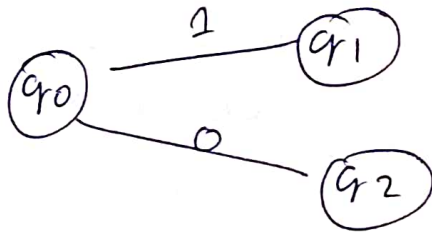
Exponential Running Time

An algorithm is said to be exponential time, if $T(n)$ is upper bounded by $2^{\text{poly}(n)}$, where $\text{poly}(n)$ is some polynomial in n . More formally, an algorithm is exponential time if $T(n)$ is bounded by $O(2^{n^k})$ for some constant.

Algo which have exponential time complexity grow much faster than polynomial algo

4. In deterministic algo, for a given particular input, the computer will always produce the same output going through the same states.

- can be solved in polynomial time.
- can be determined at next step of execution



Deterministic algorithm

The most simple deterministic algorithm is a random number generator.

5. Deterministic Algo

1. The algorithm in which the result of every algo is uniquely defined.

2. On the basis of execution and outcome in case of deterministic algo, they are also classified as reliable algo as for a particular input instruction the machine will give always the same output.

3. The path of execution for an algorithm is same in every execution.

Non-deterministic Algo

The algo in which the result of every algo is not uniquely defined and result could be random.

Non-deterministic algorithms are classified as non-reliable algo for a particular input the machine will give different output on different execution.

The path of execution is not same for algorithm in every execution.