Tuesday, November 9, 2021 10:03 AM

Design & Analysis of algorithm

What is algorithm

Blue print
Result of your thought process

Design Methodologies
- Exhaustive Search of Solution
  - brute force
- Divide & conquer
- Dynamic programming
- Greedy approach
- Back tracking
- linear programming
- other

Target to learn

problem?
n queens

problem

Solution, N
S2, Nilu
S S, Pasht
S9, Amrit
S2, Pragati

Which solution is better??

Analysis of algorithms

imp main
- ✓ time Complexity
- ✓ Space complexity → variable
- ✓ Implementation Complexity
- ✓ portability — 1 machine → 2 machine (area, area)

time required by the algorithm to solve the problem →

```
main()
{ t1 = time()
  ...
  t2 = time()
  return()
}
```

machine dependent complexity

time

$t_2 - t_1$

dependency complexity

return( )

}

Why we are interested in theoretical analysis?

M_1	M_2
Bad	Good
10^2 ins/sec	10^3 ins/sec
Student 1: $n \log n$	Student 2: n^2
$n = 1000$	
$\frac{1000 \log_{10} 1000}{100}$ sec	$\frac{1000 \times 1000}{1000}$ sec
$= 30$ sec	1000

m/c independent

Best case

Worst case

Average case

tace

Order of growth

n 1 - 10

```
Bubble_sort()
{
    for i = 1 to length.A
        For j = length.A down to i+1
            if a[j]<a[j-1]
                a[j]<-->a[j-i]
}
```

c_1: $n+1$

c_2: $\sum_{i=1}^{n}(n-i+1)$

c_3: $\sum_{i=1}^{n}(n-i)$

c_4 = 0

count swap: best → 0; worst → $c_4\sum_{i=1}^{n}(n-i)$; Avg case → worst/2

$$Time = c_1(n+1) + c_2\sum_{i=1}^{n}(n-i+1) + c_3\sum_{i=1}^{n}n-i$$

$$= \boxed{\frac{c_2+c_3}{2}}n^2 + \boxed{c_1+\frac{c_2}{2}-\frac{c_3}{2}}n + \boxed{c_1}$$

$$\text{Complexity} = \boxed{an^2+bn+k} + \begin{cases} 0 \\ c_4\sum_{i=1}^{n}(n-i) \\ \dfrac{c_4\sum_{i=1}^{n}(n-i)}{2} \end{cases}$$