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CS350

HW 4

1. Formula:

T(n)=Σ(0<r<n) Prob(r) \* (T(n-r)+T(r)+O(r(n-r)))

Guess:

T(n) = O(n^2logn) = cn^2logn

Sol:

We divide r into two set B2 {r : µ − σ ≤ r ≤ µ + σ} and B1 is the rest

(T(n-r)+T(r)+O(r(n-r))) into X(r)

T(n) = Σr∈B1 Prob(r) · X(r) + Σr∈B2 Prob(r) · X(r).

We can conclude X(µ − σ) ≥ 9 · X( 1/6 · (µ − σ)).

T(n) ≤ 2 · X( 1/6 · (µ − σ)) + Σr∈B2 P rob(r) · X(r).

T(n) ≤ (1 + 1/3 ) · Σr∈B2 Prob(r) · X(r).

Prob(r) ≤ Prob(µ)

T(n) ≤ (1 + 1/3 ) · 1 /(σ √ 2π) · (2 · Σr∈B2 T(r) + Σr∈B2 O(r(n − r))).

T(n) ≤ (1 + 1/3 ) · 1 /(σ √ 2π) · 2 · X r∈B2 T(r) + O(n^2 ).

Can be counted as

T(n) ≤ (1 + 1/3 ) · 1 /(σ √ 2π) · 2 · c · ( n/2 )^3 · log n/2 · (3 · 2)/√ n + O(n^2 ).

≤cn^2logn = O(n^2logn)

1. =Σ(n−1) (k=1) O((kn) 1.59)

O(n)^1.59 \*Σ(n−1) (k=1)(k^ 1.59)

O(n^1.59\*n^2.59)

=O(n^4.18)

1. G(n) ≤ 2 · G( n/2 ) + b · ( n/2 · n)^1.59

Guess G(n) = O((n^2 )^1.59) = c ((n^2 )^1.59)

c>>b

LHS ≤ 2 · c · ( n/2 )^(2·1.59) + b · ( n/2 · n)^1.59 ≤ c ((n^2 )^1.59)

Thus ,worst complexity is O((n^2 )^1.59).

1. We can split it into n^3 unit cubes and there are O(n^3) eight cubes. There are 2 cases to consider. Case 1 is when there’s exactly in each of unit cubes. Thus closest pair cannot be farther than 2√3 < 4. Case 2 is when there’s at least 2 airplanes in some unit cubes, means closest pair cannot be farther than √3<4. From this we can conclude that pair cannot be farther than 4. Since there is at least 1 airplane in a half cube, means there are at most 16^3 airplanes in any eight cube. Thus it means it is bounded by O(n^3)
2. We can just compute the points in the array A and that will give us O(nm). Since A[i]=A[j] but i/=j, the smallest difference of between the pairs is 0, hence running time is bounded by O(nm).