VE477 HW 4

Wu Jiayao 517370910257

October 24, 2019

1

1.1

$$T(2^{64}) = \frac{2^{64}}{33.86 \times 10^{15}} = 544.8s$$

$$T(2^{80}) = \frac{2^{80}}{33.86 \times 10^{15}} = 3.6 \times 10^{7}s$$

1.2

$$Nums\left(2^{64}\right) = \left\lceil \frac{2^{64}}{3.8 \times 10^{9} \times 86400} \right\rceil = 56186$$

$$Nums\left(2^{80}\right) = \left\lceil \frac{2^{64}}{3.8 \times 10^{9} \times 86400 \times 31} \right\rceil = 1.19 \times 10^{8}$$

1.3

$$Nums(2^{64}) = \frac{2^{64}}{8 \times 10^{12} \times 16} = 1.4 \times 10^{5}$$

$$Nums(2^{80}) = \frac{2^{80}}{8 \times 10^{12} \times 16} = 9.4 \times 10^{9}$$

2

1. create an array of size k with the first k elements in S,named $S^{'}$.
2. For the rest elements, each time when visiting an element $A[i]$, generate a random number $t = rand()\%n$, where n is the size of S. If $t \leq k$, then $S^{'}[t] = A[i]$.

3

3.1

Input : Number of layer i
Output: Sum of the ith layer
return 3^{i-1}

3.2

The complexity is $\mathcal{O}(i)$ for 3^{i-1}.

4

Omit.

5

5.1

Omit

5.2

Given a graph and a clique of k vertices, it uses at worst $\mathcal{O}(n^2)$ time to check whether the points are adjacent to each other. The answer can be worked out in polynomial time. Thus it is in $\mathcal{NP}$.

5.3

Let $C_1, C_2, \cdots, C_k$ be the clauses in F. Let $x_{j,1}, x_{j,2}, x_{j,3}$ be the literals of Cj.

1. For each literal $x_{j,q}$, create a distinct vertex in G representing it.
2. Remove edges that join two vertices which are in the same clause.
3. Remove edges that join two vertices whose literals is the negation of the others

5.4

It is $\mathcal{NP} - complete$.

6

6.1

Omit.

6.2

Given an undirected graph G and an integer k, determine whether G has a independent subset of size k.

6.3

It takes $\mathcal{O}(|V|)$ time in worst cases to check all the vertices. Since this is in polynomial time, this problem is in $\mathcal{NP}$.

6.4

Given $G = (V, E)$, we set $G' = (V', E')$ to be the complement of G where $V = V^{'}$, $G^{'}$ is the graph we construct.

6.5

It is $\mathcal{NP}$-complete problem.

Reference

[1] cs.nthu.edu.tw/~wkhon/toc07-lectures/lecture21.pdf