PHAN TICH THIET KE THUAT TOAN – CS112.L11.KHCL

Phan tich thuat toan perfectly balanced tree va quick select

Hoang Van Hung
MSSV: 18520794

Cau 1:

Thoi gian chay thuat toan tao cay nhi phan bang thuc nghiem

n	t(n)
100	0.003
450	0.032
800	0.062
1150	0.08
1500	0.081
1850	0.103
2200	0.144
2550	0.175
2900	0.17
3250	0.161
3600	0.186
3950	0.241
4300	0.327
4650	0.253
5000	0.23
5350	0.207
5700	0.22
6050	0.259
6400	0.282
6750	0.402
7100	0.464
7450	0.316

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7800	0.353
8150	0.36
8500	0.347
8850	0.391
9200	0.365
9550	0.368
9900	0.352

Do phuc tap cua thuat toan tao cay nhi phan bang thuc nghiem tu ket qua

TB lgn - n	TB sqrt(n) - c	TB n - c	TB nlgn - c	TB nˆ 2 - c	TB nˆ 3 - c
11.58011301	66.24017412	4999.760897	62881.79503	33574999.76	2.53625E+11

Ta thay trung binh chenh lech cua log n la nho nhat nen chon log n

Cau 2:
Phuong trinh de quy do phuc tap thuat toan tao cay nhi phan can bang hoan hao

$$\text{T(n)} = \begin{cases} C1 \\ T\left(\frac{n}{2}\right) + T\left(\frac{n}{2}\right) + C2 \end{cases}$$

$$\begin{aligned}
\text{T(n)} &= 2\text{T}\left(\tfrac{n}{2}\right) + \text{C2} \\
&= 2[2\text{T}\left(\tfrac{n}{4}\right) + \text{C2}] + \text{C2} \\
&= 4\text{T}\left(\tfrac{n}{4}\right) + 3\text{C2} \\
&= 4[2\text{T}\left(\tfrac{n}{8}\right) + \text{C2}] + 3\text{C2} \\
&= 8\text{T}\left(\tfrac{n}{8}\right) + 7\text{C2} \\
&= 8[2\text{T}\left(\tfrac{n}{16}\right) + \text{C2}] + 7\text{C2} \\
&= 16\text{T}\left(\tfrac{n}{16}\right) + 15\text{C2}
\end{aligned}$$

$\Rightarrow$ T(n) = $2^i\ T\left(\frac{n}{2^i}\right)$ + ($2^i - 1$ C2
Khi i = $\log_2 n$ $\Rightarrow$ nC' + (n-1) $*$ C2
$\Rightarrow$ Do phuc tap la $\log_2 n$
Cau 3:
Thoi gian chay thuat toan quick select bang thuc nghiem

k	t

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100	3.213
500	18.894
900	33.773
1300	50.718
1700	61.472
2100	76.53
2500	117.976
2900	61.802
3300	88.477
3700	182.524
4100	228.378
4500	315.38
4900	342.713
5300	393.447
5700	194.629
6100	379.642
6500	399.27
6900	565.222
7300	391.981
7700	393.284

Vay thoi gian phu thuoc vao gia tri cua k

Cau 4:
Do phuc tap quick select bang thuc nghiem tu ket qua cau 3

TB lgn - n	TB sqrt(n) - c	TB n - c	TB nlgn - c	TB n^ 2 - c	TB n^ 3 - c
203.8669332	157.3920367	3685.03375	47462.31288	20529785.03	1.21563E+11

Ta thay trung binh chenh lech ca sqrt n là nho nhat nên chn sqrt n

Cau 5:
Phuong trinh de quy do phuc tap thuat toan quick select

$$T(n) = \begin{cases} c1vin = 1 \\ cn + T\left(\frac{n}{2}\right) \end{cases}$$

$T(n) = T(\frac{n}{2}) + cn$
$= T(\frac{n}{4}) + c\frac{n}{2} + cn$
$= T(\frac{n}{8}) + c\frac{n}{4} + c\frac{n}{2} + cn$
$= T(\frac{n}{16}) + c\frac{n}{8} + c\frac{n}{4} + c\frac{n}{2} + cn$
$= T(\frac{n}{16}) + c(\frac{n}{8} + \frac{n}{4} + \frac{n}{2} + n)$
$=> T(n) = c(n + \frac{n}{2^i} + \ldots + \frac{n}{2^{i-1}} + T\left(\frac{n}{2^i}\right)$
Khi $i = \log2(n) => T(n) = c(n + \frac{n}{2} + \ldots + \frac{n}{2^{i-1}} + c'$
$= cn\left(1 + \frac{1}{2} + \ldots + \frac{1}{2^{1-1}}\right) + c'$
$= c* 2n + c' \epsilon O(n)$
=> Do phuc tap la O(n)