DATA STRUCTURES AND ALGORITHMS

Fundamentals of Data Structure in C++, second edition, Silicon Press



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1 金远平, 数据结构(++描述), 清华大学出版社, 2005







I C , a aa a a a a a a aa a a a

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物有本末,事有终始。 知所先后,则近道矣。

R a a a[0], a[1], , a[-1] a . W , a[0] <= a[1] <= <= a[-1] 8, 6, 9, 4, 3 => 3, 4, 6, 8, 9



S

G a / , a G 3, 6, 9, 14 I 5 R 3, 5, 6, 9, 14

3, 6, **9**, 14 5 **C** (5) a a (14)a **S** 14 3, 6, 9, , 14 S 9 3, 6, , 9, 14 3, , 6, 9, 14 6 I 5 3, 5, 6, 9, 14

Sa aR a

a

S 7, 3, 5, 6, 1 S a 7 a $3 \Rightarrow 3, 7$ I $5 \Rightarrow 3, 5, 7$ I $6 \Rightarrow 3, 5, 6, 7$ I $1 \Rightarrow 1, 3, 5, 6, 7$

(= 1; < a. ; ++) // a[] a[0:-1] //

$$(= 1; < a. ; ++)$$

// a[] a[0:-1]
= a[];
;
(= -1; >= 0 && < a[]; --)
a[+1] = a[];
a[+1] = ;





$$(= 1; < a. ; ++)$$

// a[] a[0:-1]
= a[];
;
(= -1; >= 0 && < a[]; --)
a[+1] = a[];
a[+1] = ;





(1)

(2)



(3)

(

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(4)

(5)

specification

implementation.

objects

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operations







(3)

(4)



(1)
 (2)
 (3)
 (4)

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(5)

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R

: 32-2, 33-14

(1) (2) •

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() + (





() + (

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++.



2 (1) (2)

1.12 =0 R (*a,) ++ //(<=0) ++ //0

2				•
• 1 I	-			
2 //		/		
3 (1	0	1	0
4	2	0	1	0
5	3	1 (>1)	1	1
6	4	0	1	0
7	5	2	1	2
	6	1		
10	7	0	-1	0
11	[/] 8	1	-1	-1
12	9	1	-1	-1
13 //		•	•	I
14				



 1,
 () 4 +1,

 0
 1,
 () 2

. ., BinarySearch.

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9

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() (²), (2), , () (()) , ()

, (3). •

() 1.



AF F #1 #2 F $^{3}+2^{2}$ $100^{2} + 1000$ 0.1 $+100^{-0.1}$ ▶ 2 + 10 5 5 -152 /100 1000^{-15} 82 $3^{7} + 7$

R $n^3 + 2n^2$. $100n^2 + 1000$







R III n + 100n^{0.1} . 2n + 10 log n







R V n⁻¹⁵2ⁿ/100 . 1000n¹⁵





TL				
F #1	F	#2	В	a
$3 + 2^{2}$	$100^{2} +$	- 1000	O(²	2)
$+100^{-0.1}$	2 + 10		O() O()
5 5	!		O(5	⁵)
$^{-15}2/100$	1000 15	5	O(1	5)
82	3 7 + 7		O(6	$\tilde{\mathcal{D}}$

С

constant: O(1)O(log n) logarithmic: O(n) linear: log-linear: O(n log n) quadratic: O(n²) polynomial: O(n^k) exponential: O(cⁿ)

(k is a constant)
(c is a constant > 1)



	()=	()= ₂	()= 2	()= 4	()= 10	()=2
10	.01µ	.03 µ	.1 μ	10 µ	10	1 μ
20	.0 <mark>2 μ</mark>	.09 µ	.4 μ	160 µ	2.84	1
30	.03 µ	.15 μ	.9 µ	810 µ	6.83	1
40	.04 µ	.21 μ	1.6 µ	2.56	121	18
50	.05 µ	.28 µ	2.5 μ	6.25	3.1	13
100	.1 μ	.66 µ	10 µ	100	3171	$4*10^{13}$
10 ³	1 μ	9.66 μ	1	16.67		
104	10 µ	130 μ	100	115.7		
10 ⁵	100 µ	1.66	10	3171		

1.8: 1- - -



S a S a (*a, ,) // S a a[0: -1].

TimeSearch ()

a[1000], n[20] r[20] = 300000, 300000, 200000, 200000, 100000, 100000, 100000, 80000, 80000, 50000, 50000, 25000, 15000, 15000, 15000, 10000, 7500, 7000, 6000, 5000,5000

$$(j=0 \ j < 1000 \ j++) \ a[j] = j+1 \ // a$$

 $n[j] = 10*j \ n[j+10] = 100*(j+1)$

<< n total r nTime <<

$$(j=0) < 20 j++)$$
interval (20 j++)
interval (2

. .

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TimeSearch

	а	Т		а	Т
0	241	0.0008	100	527	0.0105
10	533	0.0018	200	505	0.0202
20	582	0.0029	300	451	0.0301
30	<mark>736</mark>	0.0037	400	593	0.0395
40	4 <mark>67</mark>	0.0047	500	494	0.0494
50	56 <mark>5</mark>	0.0056	600	439	0.0585
60	659	0.0066	700	484	0.0691
70	604	0.0075	800	467	0.0778
80	681	0.0085	900	434	0.0868
90	472	0.0094	1000	484	0.0968

(1)
 (2)
 (3)
 (4)
 (5)

72-10