

## 6. sorting large structure

交换真实大结构数值成本过高, 替代法为仅交换指针

Table sort list [0] [1] [2] [3] [4] [5]

key d b f c a e

The sorted list is table 4 1 3 0 5 2

[list[table[0]], list[table[1]],

... list[table[n-1]]

## 7. 搜索算法下界

Theorem: 任何基于比较的搜索算法, 最坏复杂度  $\Omega(N \log N)$

Proof: when sorting  $N$  distinct elements, there are  $N!$  different results.

Any decision tree must have at least  $N!$  leaves

If the height of the tree is  $k$ , then  $N! \leq 2^{k-1}$

$$k \geq \log_2(N!) + 1$$

$$\therefore N! \geq (N/2)^{N/2} \therefore \log_2(N!) \geq (N/2) \log_2(N/2) = \Theta(N \log N)$$

$$\therefore T(N) = k \geq C \cdot N \log N$$

## 8. Bucket Sort and Radix Sort

桶排:

$$T(N, M) = O(M + N)$$

Radix Sort: 数到最高位即为执行轮次

原始数组: 72, 99, 6, 25, 17, 22, 35, 64, 98, 12

0 1 2 3 4 5 6 7 8 9

round 1

round 2

round 3

round 4

round 5

round 6

round 7

round 8

round 9

round 10

round 11

round 12

round 13

round 14

round 15

round 16

round 17

round 18

round 19

round 20

round 21

round 22

round 23

round 24

round 25

round 26

round 27

round 28

round 29

round 30

round 31

round 32

round 33

round 34

round 35

round 36

round 37

round 38

round 39

round 40

## MSD (Most Significant Digit)

## LSD (Least Significant Digit)

适用于 bucket 远多于数据的情况

## Chap 7 Hashing

### 1. Symbol Table ADT

A set of name-attribute pairs, where the names are unique

Operation: Create() isInTable() Find() insert() delete()

ht[0] ht[1] b buckets

ht[2] ht[3] s slots

ht[4] ht[5] b buckets

ht[6] ht[7] s slots

ht[8] ht[9] b buckets

ht[10] ht[11] s slots

ht[12] ht[13] b buckets

ht[14] ht[15] s slots

ht[16] ht[17] b buckets

ht[18] ht[19] s slots

ht[20] ht[21] b buckets

ht[22] ht[23] s slots

ht[24] ht[25] b buckets

ht[26] ht[27] s slots

ht[28] ht[29] b buckets

ht[30] ht[31] s slots

ht[32] ht[33] b buckets

ht[34] ht[35] s slots

ht[36] ht[37] b buckets

ht[38] ht[39] s slots

ht[40] ht[41] b buckets

ht[42] ht[43] s slots

ht[44] ht[45] b buckets

ht[46] ht[47] s slots

ht[48] ht[49] b buckets

ht[50] ht[51] s slots

ht[52] ht[53] b buckets

ht[54] ht[55] s slots

ht[56] ht[57] b buckets

ht[58] ht[59] s slots

ht[60] ht[61] b buckets

ht[62] ht[63] s slots

ht[64] ht[65] b buckets

ht[66] ht[67] s slots

ht[68] ht[69] b buckets

ht[70] ht[71] s slots

ht[72] ht[73] b buckets

ht[74] ht[75] s slots

ht[76] ht[77] b buckets

ht[78] ht[79] s slots

ht[80] ht[81] b buckets

ht[82] ht[83] s slots

ht[84] ht[85] b buckets

ht[86] ht[87] s slots

ht[88] ht[89] b buckets

ht[90] ht[91] s slots

ht[92] ht[93] b buckets

ht[94] ht[95] s slots

ht[96] ht[97] b buckets

ht[98] ht[99] s slots

ht[100] ht[101] b buckets

ht[102] ht[103] s slots

ht[104] ht[105] b buckets

ht[106] ht[107] s slots

ht[108] ht[109] b buckets

ht[110] ht[111] s slots

ht[112] ht[113] b buckets

ht[114] ht[115] s slots

ht[116] ht[117] b buckets

ht[118] ht[119] s slots

ht[120] ht[121] b buckets

ht[122] ht[123] s slots

ht[124] ht[125] b buckets

ht[126] ht[127] s slots

ht[128] ht[129] b buckets

ht[130] ht[131] s slots

ht[132] ht[133] b buckets

ht[134] ht[135] s slots

ht[136] ht[137] b buckets

ht[138] ht[139] s slots

ht[140] ht[141] b buckets

ht[142] ht[143] s slots

ht[144] ht[145] b buckets

ht[146] ht[147] s slots

ht[148] ht[149] b buckets

ht[150] ht[151] s slots

ht[152] ht[153] b buckets

ht[154] ht[155] s slots

ht[156] ht[157] b buckets

ht[158] ht[159] s slots

ht[160] ht[161] b buckets

ht[162] ht[163] s slots

ht[164] ht[165] b buckets

ht[166] ht[167] s slots

ht[168] ht[169] b buckets

ht[170] ht[171] s slots

ht[172] ht[173] b buckets

ht[174] ht[175] s slots

ht[176] ht[177] b buckets

ht[178] ht[179] s slots

ht[180] ht[181] b buckets

ht[182] ht[183] s slots

ht[184] ht[185] b buckets

ht[186] ht[187] s slots

ht[188] ht[189] b buckets

ht[190] ht[191] s slots

ht[192] ht[193] b buckets

ht[194] ht[195] s slots

ht[196] ht[197] b buckets

ht[198] ht[199] s slots

ht[200] ht[201] b buckets

ht[202] ht[203] s slots

ht[204] ht[205] b buckets

ht[206] ht[207] s slots

ht[208] ht[209] b buckets

ht[210] ht[211] s slots

ht[212] ht[213] b buckets

ht[214] ht[215] s slots

ht[216] ht[217] b buckets

ht[218] ht[219] s slots

ht[220] ht[221] b buckets

ht[222] ht[223] s slots

ht[224] ht[225] b buckets

ht[226] ht[227] s slots

ht[228] ht[229] b buckets

ht[230] ht[231] s slots

ht[232] ht[233] b buckets

ht[234] ht[235] s slots

ht[236] ht[237] b buckets

ht[238] ht[239] s slots

ht[240] ht[241] b buckets

ht[242] ht[243] s slots

ht[244] ht[245] b buckets

ht[246] ht[247] s slots

ht[248] ht[249] b buckets

ht[250] ht[251] s slots

ht[252] ht[253] b buckets

ht[254] ht[255] s slots

ht[256] ht[257] b buckets

ht[258] ht[259] s slots

ht[260] ht[261] b buckets

ht[262] ht[263] s slots

ht[264] ht[265] b buckets

ht[266] ht[267] s slots

ht[268] ht[269] b buckets

ht[270] ht[271] s slots

ht[272] ht[273] b buckets

ht[274] ht[275] s slots

ht[276] ht[277] b buckets

ht[278] ht[279] s slots

ht[280] ht[281] b buckets

ht[282] ht[283] s slots

ht[284] ht[285] b buckets

ht[286] ht[287] s slots

ht[288] ht[289] b buckets

ht[290] ht[291] s slots

ht[292] ht[293] b buckets

ht[294] ht[295] s slots

ht[296] ht[297] b buckets

ht[298] ht[299] s slots

ht[300] ht[301] b buckets

ht[302] ht[303] s slots

ht[304] ht[305] b buckets

ht[306] ht[307] s slots

ht[308] ht[309] b buckets

ht[310] ht[311] s slots

ht[312] ht[313] b buckets

ht[314] ht[315] s slots

ht[316] ht[317] b buckets

ht[318] ht[319] s slots

ht[320] ht[321] b buckets

ht[322] ht[323] s slots

ht[324] ht[325] b buckets

ht[326] ht[327] s slots

ht[328] ht[329] b buckets

ht[330] ht[331] s slots

ht[332] ht[333] b buckets

ht[334] ht[335] s slots

ht[336] ht[337] b buckets

ht[338] ht[339] s slots

ht[340] ht[341] b buckets

ht[342] ht[343] s slots

ht[344] ht[345] b buckets

ht[346] ht[347] s slots

ht[348] ht[349] b buckets

ht[350] ht[351] s slots

ht[352] ht[353] b buckets

ht[354] ht[355] s slots

ht[356] ht[357] b buckets

ht[358] ht[359] s slots

ht[360] ht[361] b buckets

ht[362] ht[363] s slots