

Data record : Name : char[30]
 Age : int 32
 Id : int 32

Secondary indirect index			Primary file				Male/Female Bitmap	
Block	Age	Primary key (Id)	Block	Name	age	Id	M/F	
101	3	6	10	Maria	32	0	1	
	11	7		Jan	11	1	0	
	13	15		Petr	26	2	0	
102	18	5	11	Pavel	29	3	0	
	26	2		Filip	36	4	0	
	27	9		Karel	18	5	0	
103	29	3	12	Lucie	3	6	1	
	32	0		Jitka	55	7	1	
	36	4		Roman	78	8	0	
104	37	10	7	Vlasta	27	9	1	
	42	12		Marta	32	10	1	
	46	13		Olga	53	11	0	
105	53	11	6	Ivan	42	12	0	
	55	9		Adam	46	13	0	
	61	14		Alice	61	14	1	
	78	8		Isor	73	15	0	

Primary index		
Block	Id	Block Ptr
10	0	0
	2	1
	4	2
11	6	3
	8	4
	10	5
12	12	6
	14	7

Secondary direct index

Block	Age	Block Ptr
1001	3	3
	11	0
	13	7
1002	18	2
	26	1
	27	4
1003	29	1
	32	0
	36	2
1004	37	5
	42	6
	46	6
1005	53	5
	55	3
	61	7
	78	4

Primary file

Primary key

Block	Name	age	Id
0	Marie	32	0
1	Jan	11	1
1	Petr	26	2
1	Pavel	29	3
2	Filip	36	4
2	Karel	18	5
3	Lucie	3	6
3	Sitka	55	7
4	Roman	78	8
4	Vlasta	27	9
5	Marta	37	10
5	Olga	53	11
6	Ivan	42	12
6	Adam	46	13
7	Sona	61	14
7	Isar	73	15

3) Velikosti vztich dat

Data record:
name: char[30] - 30B
Age: int 32 - 4B
Id: int 32 - 4B

38B

$$b_{\text{prim. file}} = \left\lfloor \frac{4096}{38} \right\rfloor = 107$$

$$n_{\text{records}} = 5 \cdot 10^6$$

$$n_{\text{blocks}} = \left\lceil \frac{5 \cdot 10^6}{b_{\text{prim. file}}} \right\rceil = 467290$$

$$\text{Size}_{\text{prim. file}} = n_{\text{block}} \cdot 4k:B =$$

$$= 467290 \cdot 4096 = 1,914,019,840 \text{ B} = 1.786 \text{ B}$$

Prim. index record: Id: int 32 - 4B

Ptr: int 32 - 4B

8B

$$b_{\text{prim. index}} = \frac{4096}{8} = 512$$

$$n_{\text{blocks}} = \left\lceil \frac{467290}{512} \right\rceil = 913$$

$$\text{Size}_{\text{prim. index}} = 913 \cdot 4096 = 3739648 \text{ B}$$

$$\text{lookup} = \text{bin search over ID} + 1 = O(\log_2 913) + 1$$

Sec. direct index:

age - 4B

ptr - 4B

8B

$$b = \frac{4096}{8} = 512$$

$$n_{\text{blocks}} = \left\lceil \frac{5 \cdot 10^6}{512} \right\rceil = 97657$$

$$\text{Size}_{\text{sec. direct index}} = 97656 \cdot 4096 = 400,003,072 \text{ B}$$

$$\text{lookup: bin search over age} + 1 = O(\log_2 97657) + 1$$

Secondary indirect index record:

age: int32 - 4B

Id: int32 - 4B

8B

\Rightarrow sizes are the same as in the case of direct idx

lookup: binary search over age +
+ binary search over prim. index + 1
 $= O(\log_2 97657) + O(\log_2 913) + 1$

Bitmaps record:

M/F: bool - 1 bit = 0.125B

$$b_{\text{bitmap}} = \frac{4096}{0.125} = 32768$$

$$n_{\text{blocks}} = \left\lceil \frac{5 \cdot 10^6}{32768} \right\rceil = 1526$$

$$\text{Size}_{\text{bitmap}} = 4096 \cdot 1526 = 6\,250\,496 \text{ B}$$