



Solution

NDBI007: Practical class 2



Exercise 2.1: Primary Key Index (Solution)

- ❖ Blocking factor of primary file $b = \left\lfloor \frac{B}{R} \right\rfloor = \left\lfloor \frac{4 \cdot 2^{10}}{256} \right\rfloor = 16$
 - ❖ Number of blocks of primary file $n_B = 12,000,000 \div 16 = 750,000$
 - ❖ Blocking factor of primary key index $b_{ID} = \left\lfloor \frac{B}{R} \right\rfloor = \left\lfloor \frac{4 \cdot 2^{10}}{9} \right\rfloor = 455$
- ❖ Primary key index levels
 - ❖ The number of pages to index: 750,000, level size: $n_{PAGES, L=i} = \left\lceil \frac{n_{PAGES, L=i-1}}{b} \right\rceil = \left\lceil \frac{750,000}{455} \right\rceil = 1649$
 - ❖ The number of pages to index: 1649, level size: $\left\lceil \frac{1649}{455} \right\rceil = 4$
 - ❖ The number of pages to index: 4, level size: $\left\lceil \frac{4}{455} \right\rceil = 1$

Exercise 2.2: Direct Index (Solution)

❖ Blocking factor $b_{FIRST_NAME} = \left\lfloor \frac{B}{R} \right\rfloor = \left\lfloor \frac{4 \cdot 2^{10}}{29} \right\rfloor = 141$

❖ Direct index levels

❖ Number of records in primary file: 12,000,000, level size: $\left\lceil \frac{12,000,000}{141} \right\rceil = 85,107$

❖ Number of pages to address: 85,107, level size: $\left\lceil \frac{85,107}{141} \right\rceil = 604$

❖ Number of pages to address: 604, level size: $\left\lceil \frac{604}{141} \right\rceil = 5$

❖ Number of pages to address: 5, level size: $\left\lceil \frac{5}{141} \right\rceil = 1$

❖ The total size of index is $85,107 + 604 + 5 + 1 = 85,717$ so the space equals to $85,717 \cdot 4 \cdot 2^{10} \approx 335 \text{ MB}$

❖ The size of this index is much larger than the size of the primary key index, i.e., that is $(1649 + 4 + 1) \cdot 4 \cdot 2^{10} \approx 6 \text{ MB}$

Exercise 2.3: Indirect Index (Solution)

- ❖ First level blocking factor is $b_{SECOND_NAME, FIRST_LEVEL} = \left\lfloor \frac{B}{R} \right\rfloor = \left\lfloor \frac{4 \cdot 2^{10}}{37} \right\rfloor = 110$
- ❖ Other level blocking factor is $b_{SECOND_NAME, OTHER_LEVELS} = \left\lfloor \frac{B}{R} \right\rfloor = \left\lfloor \frac{4 \cdot 2^{10}}{36} \right\rfloor = 113$
- ❖ Indirect index levels
 - ❖ Number of records to address: 12,000,000, level size: $\left\lceil \frac{12,000,000}{110} \right\rceil = 109,091$
 - ❖ Number of pages to address: 109,091, level size: $\left\lceil \frac{109,091}{113} \right\rceil = 966$
 - ❖ Number of pages to address: 966, level size: $\left\lceil \frac{966}{113} \right\rceil = 9$
 - ❖ Number of pages to address: 9, level size: $\left\lceil \frac{9}{113} \right\rceil = 1$