Exercise 5 (Indexes: s.35ff) Suppose blocks can hold three records or ten key-pointer pairs. Let $n$ be the number of records. How many blocks, as a function of $n$, do we need to hold the data file and...

a) ... a dense index?

b) ... a sparse index?

Exercise 6 Consider the situation from the previous exercise, but now duplicate search key occur: 1/3 of the keys appear exactly twice, 1/3 exactly three times, and the rest of the keys appear just once in the records. Consider a dense index with only one key-pointer pair per key value (to the first record with that key). Assuming now blocks are in memory initially, what is the average number of disk I/O's needed to find all records with key $K$ (assume that the location of the index block containing $K$ is known, but it is on disk).

Exercise 7 (Deletions, Insertions) Consider the sparse index on s.37. Delete the records with key values 70, 80, and 90, then insert records with keys 31, 32, ..., 39. Assume extra space is obtained using overflow blocks. How does the resulting data structure look like?

Exercise 8 (Buckets) Suppose that blocks can hold either three records, ten key-pointer pairs, or fifty pointers (s.47). If the average search-key value appears in 10 records, how many blocks do we need to hold 3000 records and its secondary index? And how many block if we did not use buckets?