

Implementation of DBMS
Exercise Sheet 3
Klingemann, WS 2025 / 2026

- 1) Suppose a record has no header but the following fields in this order: A character string of length 25 bytes, an integer of 2 bytes, an SQL date (requires 10 bytes), and an SQL time (no decimal point, requires 8 bytes). How many bytes does the record take if
 - a) Fields can start at any byte.
 - b) Fields must start at a byte that is a multiple of 4.
 - c) Fields must start at a byte that is a multiple of 8.
- 2) Assume the fields are as in Exercise 1, but the records also include a header consisting of two 4-byte integers and a character. Calculate the record length for the three situations regarding field alignment a) through c).
- 3) Suppose records are as in Exercise 2, and we wish to pack as many records as we can into a block of 4096 bytes, using a block header that consists of ten 4-byte integers. How many records can we fit in the block in each of the three situations regarding field alignment a) through c)? We use unspanned storage of records, i.e., a record must not be divided but stored completely within one block.
- 4) A patient record consists of the following fixed-length fields: the patient's date of birth, social-security number, and patient ID, each 10 bytes long. It also has the following variable-length fields: name, address, and patient history. If each pointer within a record requires 4 bytes, and a field for the record-length is a 4-byte integer, how many bytes, exclusive of the space needed for the variable-length fields, are needed for the record? The record header should consist of the record length and pointers to the variable-length fields. You may assume that no alignment of fields is required. Can you further reduce the record size by optimising its internal organization?
- 5) Suppose records are as in Exercise 4) and the variable-length fields name, address, and history each have a length that is uniformly distributed. For the name the range is 10-50 bytes; for address it is 20-80 bytes, and for history it is 0-1000 bytes. What is the average length of a patient record?
- 6) Suppose we have a relation whose n tuples each require R bytes, and we have a machine whose main memory M and disk-block-size are just sufficient to sort the n tuples using Two-Phase Multiway Merge Sort. How would the maximum n change if we made one of the following modifications of parameters?
 - a) Double B
 - b) Double R
 - c) Double M