

Implementation of DBMS
Exercise Sheet 3
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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