Suppose we have blocks of size 4096 bytes that we use to store fixed-length records. Each block has a 128 byte header used to store information including the number of records in the block.

(1) Suppose we have records consisting of a 12 byte header, and 3 fields of size 16 bytes, 32 bytes and 70 bytes respectively. Within each record, fields can start at any byte. How many records can we put in a block?

(2) Suppose that we have 5 records, each with a 24 byte header and 1300 bytes of data.

(i) How many blocks will we need to store these 5 records if no spanning is allowed?

(ii) How much total free space is there in the blocks if no spanning is allowed? (Assume we are not storing anything else)

(iii) How many blocks will we need to store these 5 records if spanning is allowed? In addition to the record header, each time a record is split into fragments, each fragment needs an extra header of 12 bytes.

**Answer：**

（1）对于具有12字节头部和分别为16字节、32字节和70字节的3个字段的记录：

每条记录的总长度为：12字节（头部） + 16字节 + 32字节 + 70字节 = 130字节。

块中可容纳的记录数量为：（4096-128）字节（块大小） / 130字节（每条记录大小）≈ 30.52

因此，我们可以在一个块中存储约 30 条记录。

（2）

(i) 对于具有24字节头部和1300字节数据的5条记录：

每条记录的总长度为：24字节（头部）+1300字节=1324字节。

一个块中可存储的最大记录条数（不允许跨区块存储）为：⌊（4096-128）/1324⌋=2条。

总共需要的块数为：⌈5/2⌉=3块。

因此，我们总共需要3个块数。

(ii)总共的空闲空间为:

(4096-128-1324\*2)\*2+(4096-128-1324)=1320\*2+2644=5284字节

因此，总共还有5284字节空闲空间。

(iii)拆分后的记录总长度为：x1+12字节与x2+12字节，其中x1+x2=1324字节

对于第一个块，可以存储⌊4096-128/1324⌋=2条+4096-128-1324\*2-12=1308字节。

则第二个块，在存储两条记录后，仍剩余4096-128-1324\*2=1320字节

1320-12-（1324-1308）=1292字节>0，所以足够存储

因此，总共需要两个块。

Now consider blocks of size 4096 bytes that we use to store variable-length records. Each block has a fixed 128 byte header used to store information including the number of records in the block. In addition to this fixed header, the header contains variable number of 4 byte pointers to each record in the block. Records can start at any byte oﬀset and are packed as densely as possible. Which of these following combinations of records can be stored in a single block? Circle all that apply.

(i) 59 records of 63 bytes each

(ii) 30 records of 94 bytes each and 10 records of 100 bytes each

(iii) 50 records of 11 bytes, 10 records of 13 bytes and 20 records of 148 bytes

(iv) 2 records of size 1982

**Answer：**

1. 可以存储。

59条记录 \* 63字节/条 = 3717字节

3717字节 + 59条记录 \* 4字节/条 = 3953字节

3953字节 + 128字节 = 4801字节 < 4096字节（块大小）

1. 不能存储。

30条记录 \* 94字节/条 + 10条记录 \* 100字节/条 = 3820字节

3820字节 + 40条记录 \* 4字节/条 = 3980字节

3980字节 + 128字节 = 4108字节 > 4096字节（块大小）

1. 可以存储。

50条记录 \* 11字节/条 + 10条记录 \* 13字节/条 + 20条记录 \* 148字节/条 = 3640字节

3640字节 + 80条记录 \* 4字节/条 = 3960字节

3960字节 + 128字节 = 4088字节 < 4096字节（块大小）

1. 不能存储。

2条记录 \* 1982字节/条 = 3964字节

3964字节 + 2条记录 \* 4字节/条 = 3972字节

3972字节 + 128字节 = 4100字节 > 4096字节（块大小）