

## Homework 2 Index Structures

**Due:** *Friday, February 20, in-class*

**Submission.** I encourage everyone to use text-processing software for the solutions and use PowerPoint, xfig or other graphical tools to draw pictures/diagrams required in this homework. (I will accept handwritten solutions, but I discourage them. This policy is mainly to ensure expedient and error-free grading).

### Problems

Consider a database relation  $R$  with an integer key  $X$ , which needs to be indexed.  $X$  has no duplicate keys. We consider the following two file organizations:

**Data File A.** Data file A is a sequential file with  $X$  as the search key. Each disk page can store four (4) records from the relation  $R$  on it.

**Data File B.** Data file B is a heap file. Each disk page can store three (3) records from the relation  $R$  on it.

Consider the following sequence of insertion and deletion operations for the relation  $R$ . For simplicity, `Insert(10)` means “insert a record with the value of  $X$  attribute set to 10”.

```
Create(R);
```

```
Insert(100);  
Insert(10);  
Insert(65);  
Insert(15);  
Insert(80);
```

```
Insert(20);  
Insert(35);
```

```
Delete(65);
Delete(80);
Insert(75);
```

```
Insert(70);
Insert(120);
Delete(15);
Delete(10);
Insert(35);
```

```
Insert(60);
Insert(55);
Delete(75);
Insert(160);
Delete(120);
```

```
Insert(75);
Insert(10);
Insert(40);
Delete(110);
Insert(95);
```

### Problem 1

For each data file structure (A and B), show the state of the data files after each five **Insert/Delete** operations. For each disk page, show only pageID and any pointers you may have in the header (nothing else is needed for this exercise). You can omit the header page - just show the pages with the data.

### Problem 2

For Data File A, show the state of the following index files after every five **Insert/Delete** operations:

1. Simple Dense index (8 index records per page) on  $X$ ;
2. Simple Sparse (5 index records per page) index on  $X$ .
3. Dense B+-tree (3 key values per page) index on  $X$ ;

### Problem 3

For Data File B, show the state of the following index files after every five **InsertDelete** operations:

1. Simple secondary index (5 index records per page) on  $X$ ;
2. B+-tree secondary index (4 key values per page) on  $X$ ;