CS186 Discussion Section Week 4 Solutions
Hash Based Indexing and Relational Algebra
Fall 2013

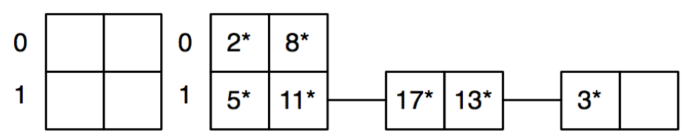
Hash Indexing

1. When would we use a tree over a hash index and vice versa?
    a. **Hash-based indexing is best for equality searches but does not support range queries.**
    b. **Tree-based indexing is best for range queries, supports equality searches but not as efficient as hashing.**

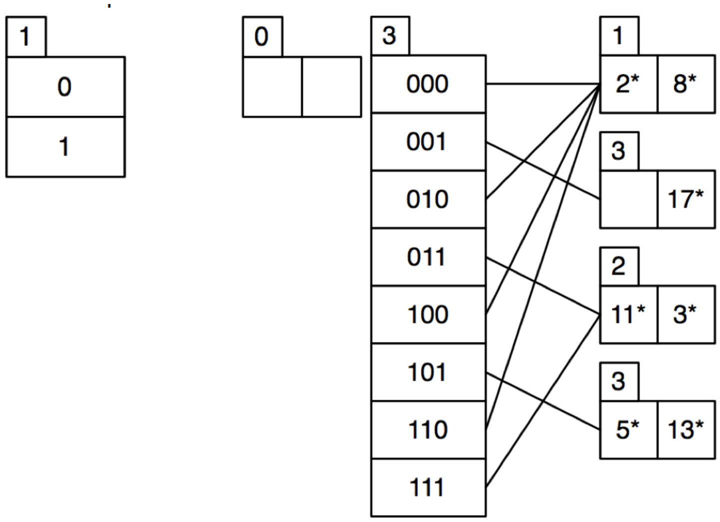
2. What is the difference between static, extendible and linear hashing?
    a. **Static: Fixed number of buckets and fixed bucket size. One hash function. Overflow chains.**
    b. **Extendible: When inserting into a full bucket make split image of the bucket and double directory if needed. Based on global depth (bits in directory) and local depth (bits used to address a bucket).**
    c. **Linear: Round Robin fashion with triggered splits. Temporary short overflow pages.**

3. Consider the following sequence of insertion in a hash index. All pages hold 2 data entries. Draw the structure for the different types of hashing.
Sequence of H(key): 5(00101), 11(01011), 2(00010), 17(10001), 8(01000), 13(01101), 3(00011)

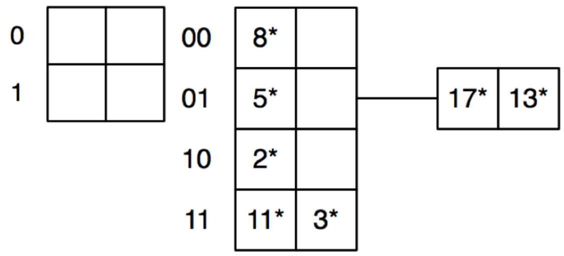
Static hashing: We have 2 buckets.



Extendible Hashing: We start with 2 directory slots and 1 data bucket. Draw pointer lines and find the global and local depth of each bucket.



Linear Hashing: We start with 2 buckets. A split is triggered by the creation of any overflow page.



Relational Algebra

Consider the schema:

Suppliers(sid:integer, sname:string, address:string)
Parts(pid:integer, pname:string, color:string)
Catalog(sid:integer, pid:integer, cost:real)

Write relational algebra expressions for the following queries:

1. Find the SIDs of all suppliers who supply either a red or a green part.

   π catalog.sid (Catalog $\bowtie$ (σ parts.color = ‘red’ $\lor$ parts.color = ‘green’ Parts))

2. Find the SIDs of all suppliers who supply both a red part and a green part.

   π catalog.sid ((σ parts.color = ‘red’ Parts) $\bowtie$ Catalog) $\cap$ π catalog.sid ((σ parts.color = ‘green’ Parts) $\bowtie$ Catalog)

3. Find the SIDs of all suppliers who supply either a red part or are located at “123 University”.

   π catalog.sid (Catalog $\bowtie$ (σ parts.color = ‘red’ Parts)) $\cup$ π suppliers.sid (σ suppliers.address = ‘123 University’ Suppliers)

4. Find the PIDs of all parts that are supplied by two or more suppliers.

   ρ(c1, Catalog)

   ρ(c2, Catalog)

   π c1.pid (c1 $\bowtie$ c1.pid = c2.pid $\land$ c1.sid $<>$ c2.sid c2)

5. Find the names of all suppliers who do not supply any parts.

   π suppliers.name (Suppliers $\bowtie$ ((π suppliers.sid Suppliers) - (π catalog.sid Catalog)))