**Design Report(Group 14)**

**Intro**

For our project 3 we implemented a B+ tree index to further the Buffer Manager program. Our B+ tree uses a search key of type integer to traverse the tree to find corresponding record id pairs. This allows us to efficiently travers the database, since it is self-balancing, in O(log n) for search, insert, and delete.

**Traversing the B+ tree**

The advantage of using a B+ tree is we can traverse trough the tree much like a linked list to find a page/key pair. The nodes contain a pointer to the next node and the key value. Using these nodes, we can traverse the tree in an ordered manner. Since the B+ tree is ordered by left child nodes being less than the parent, right child nodes being greater than the parent, and the middle in-between the two values, we can use this information to efficiently travers the tree.

**Design Choices**

We implemented the B+ tree by consistently calling InserEntry() to insert any new pages. From this point we determine where the entry should go based on the depth of the tree and the balance.

**Unpin Page**

We decided to unpin the pages as soon as possible. This allows us to keep the buffer pool from filling up. This allows us to speed up the program since the I/O would be a bottle neck, and we are now replacing that with CPU cycles, which are must faster.

**Efficiency**

Search: searching the tree will result in a I/O cost of 2\*height, since we need to read in and write out through the pages.

Insert: If the root node empty, inserting will be a simple I/O cost of 2, since we are writing directly to the root node of the tree. If it is not empty, we recursively added the new nodes.

Scanning: Scanning the tree will have a worst-case scenario of O(log n) if we need to read every leaf node, or the same as Search.

Splitting: Splitting results in a I/O cost of 4. This is due to the need of reading in and writing both the current node and the new node we are creating in the split.

**Extra Tests**

**Test 4:**

We create an empty B+ tree and run tests to make sure it scans properly. Each call of intScan should throw and catch a NoSuchKeyFoundException and return 0.

**Test 5:**

Create a B+ tree with tuples valued 0 to 100000 in a random order. Tests if the program will run when tasked with an excessive amount. Might run out of buffer space, if unpin page doesn’t work properly.