**Homework 8 for CS542 - Fall 2023**

**Assigned: Wednesday, October 25th, 2023**

**Due: Wednesday, November 1st, 2023 10 am ET**

**Maximum Points: 100 pts**

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**Problem: B+ Index Trees and Properties [100 pts]**

Assume that you have just built a dense B+ tree index using Alternative (2) on a heap file containing 20,000 records. alternative (2) means that it contains the search key value being indexed and the pointer, but no other values of the data records.

The key field for this B+ tree index is a 40-byte string, and it is a candidate key. Pointers (i.e., record ids and page ids) are (at most) 20-byte values. The size of one disk page is 1,000 bytes. The index was built in a bottom-up fashion using the bulk-loading algorithm, that is, the nodes at each level were filled up as much as possible.

1. How many levels does the resulting tree have? **[ 40 pts]**
2. For each level of the tree, how many nodes are at that level? **[ 40 pts]**
3. How many levels would the resulting tree have if key compression is used and it reduces the average size of each key in an entry to 10 bytes? **[ 20 pts]**