Exercise 2

Time tip: Roughly 1min per 1pt
Exercise

Q1) [4 x 6pts] Consider the following B+ tree index. Each page can hold 4 entries. Draw the index after each of the following operations has finished (each bullet is independent). Follow all conventions for tree indexes given in the lectures.

A. Insert 23*
B. Insert 22*
C. Delete 34*
D. Delete x WHERE x MOD 5 = 0
Exercise

Q2) [2 x 8pts] Consider the following B+ tree index. Each page can hold 4 entries. Draw the index after each of the following sequence of operations have finished (each bullet is independent). Follow all conventions for trees again.

A. Insert 7*; Delete 22*

B. Delete 60*; Insert 80*; Insert 83*
Exercise

Q3) [4 x 6pts] Consider the following extendible hash index.

Each bucket can hold 4 entries. Draw the index after each of the following sequence of operations have finished (each bullet is independent).

A. Insert 22*
B. Delete 21*
C. Insert 19*; Insert 35*
D. Insert 7*; Insert 7*
Exercise

Q4) [6 x 5pts] You need to sort a file with 20 million pages. You are given B buffer pages for this. What is the total number of passes needed for the following EMS regimes for B = 100? What if B = 5000? What if B = 30 million?
A. Standard EMS
B. Do internal replacement sort
C. Do double buffering
D. Do blocked I/O with b = 10
E. Do both B and C
F. Do all of B, C, and D
Exercise

Q5) [5pts] What is the largest file size you can sort with just 2 passes given B buffer pages for EMS? Use any optimization(s) from those discussed in the lectures. Write the closed form expression in terms of B.
(Extra Credit; Optional) Q6) [6pts] Suppose you are given a B+ tree index of height 2h and order d. The fanout of each node at the top h levels is d; the rest have fanout 2d. Level 0 is the root. What is the total number of nodes in this index? Write the closed-form expression in terms of h and d.
(Extra Credit; Optional) Q7) [8pts] Suppose you are given a valid extendible hash index whose GD is k (>=2). What is the minimum possible number of unique bucket pointers in the directory?