

Homework 8

1.

Each node has N keys and N+1 pointers.

Records = 20000, Key field 40-byte string Pointers = 20 bytes

Size of disk page = 1000 bytes

$$40N + 20(N+1) = 1000$$

$$40N + 20N + 20 = 1000$$

$$60N = 980$$

$$N = 16$$

We have 16 keys and 17 pointers.

Size of record = 40 + 20 = 60 bytes Leaf page space = $1000/60 = 16$

$$\text{Levels} = \log_{17}(20000/16) + 1 = 3.52 \sim 4 \text{ levels}$$

THUS, RESULTING TREE WILL HAVE 4 LEVELS

2.

$$\text{NUMBER OF LEAF NODES ON LEVEL 4} = 20000/16 = 1250$$

$$\text{NUMBER OF LEAF NODES ON LEVEL 3} = 1250/17 = 73$$

$$\text{NUMBER OF LEAF NODES ON LEVEL 2} = 73/17 = 4$$

LEVEL 1 IS THE ROOT NODE

THUS, EACH LEVEL 1250, 73, 4 AND 1 NODES WILL BE THERE RESPECTIVELY.

3.

Key size in each node = 10 Bytes

$$\text{New leaf page capacity} = (1000 - 20) / (10 + 20) = 980 / 30 \approx 33 \text{ records}$$

$$\text{Levels} = \log_{17}(20000 / 33) + 1 = 3.16 \sim 3 \text{ levels}$$

SO, WITH KEY COMPRESSION REDUCING THE AVERAGE SIZE OF EACH KEY TO 10 BYTES, THE RESULTING B+ TREE WOULD STILL HAVE APPROXIMATELY 3 LEVELS.