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Section 1B

Homework 4

1. a. 6*10,000*500*1024 = 30720000000bytes = 30GB

   b. seek time = 10ms
      rotational delay = (1000ms/s)(1s/100rot)(1/2) = 5ms
      transfer time = (1000ms/s)(1s/100rot)(1track/500sector) = 0.02ms

      access time = 10+5+0.02 = 15.02ms

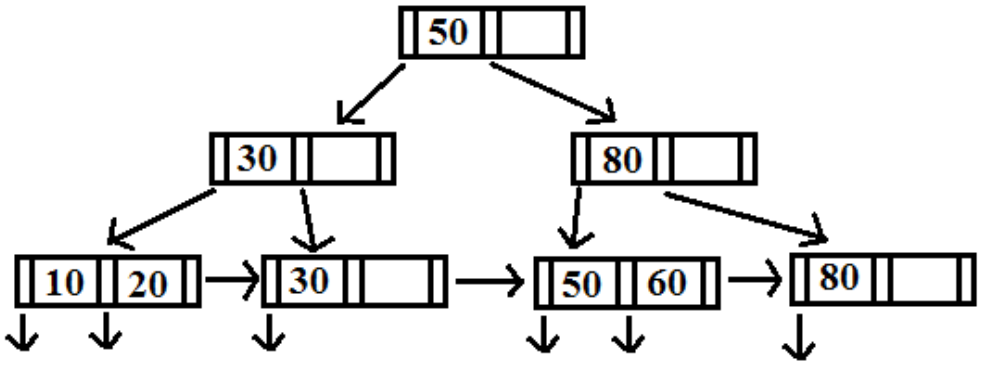
   c. 1 tuple: 2+4+4+4+4+4+30+20 = 72 bytes
      1024bytes/72bytes = 14 tuples/block
      1000tuples/14 tuples/block = 72 blocks

   d. transfer time = 72*0.02 = 1.44ms
      time for query = 10+5+1.44 = 16.44ms

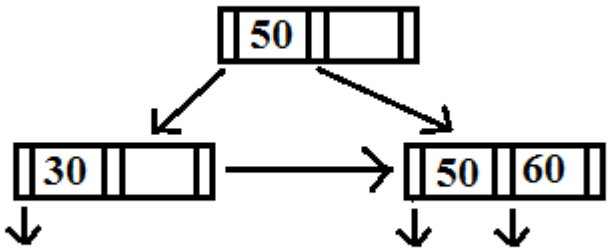
   e. 24 (10+5+3*0.02) = 361.44ms

   f. 10 classes every year
      10 (10+5+0.02) = 150.2ms
      The tree is useful if the blocks are randomly scattered but slow if the blocks are sequential

2. a.



b.

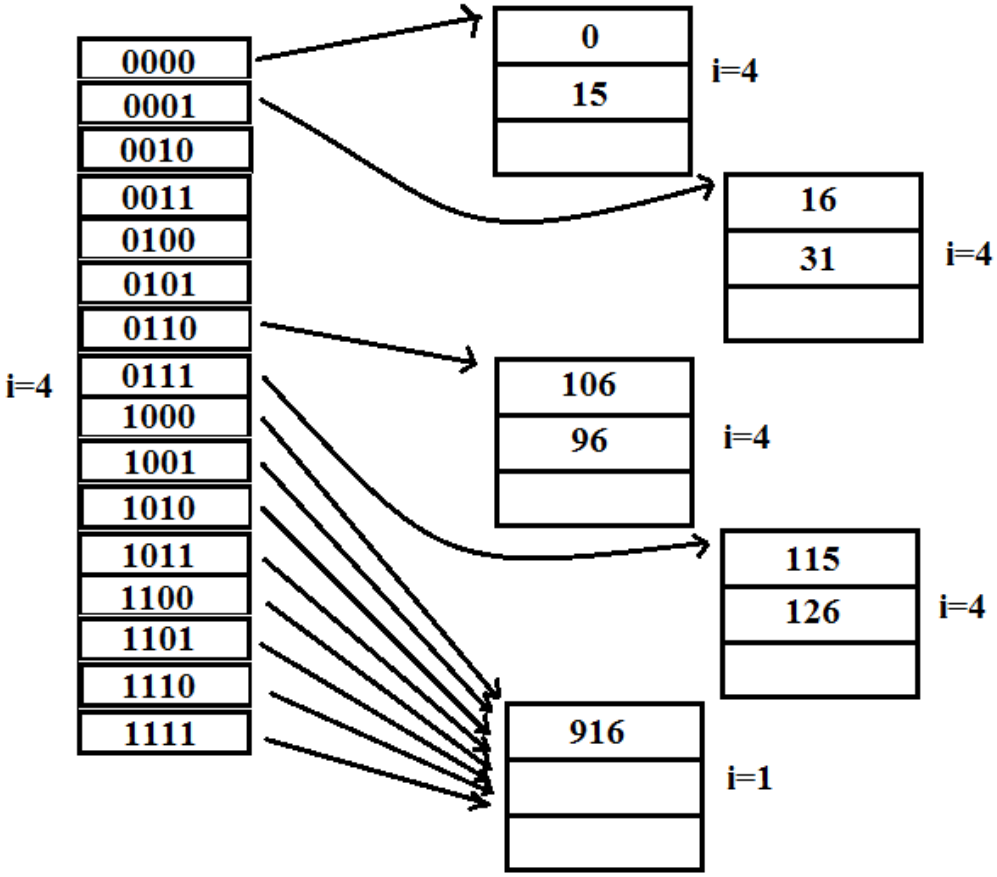


3. a. Minimum height:
   300/4 = 75 leaf nodes
   75/5 = 15 non-leaf nodes
   15/5 = 3 non-leaf nodes
   3/5 = 1 root node
   Minimum height is 4

   Maximum height:
   300/2 = 150 leaf nodes
   150/3 = 50 non-leaf nodes
   50/3 = 16 non-leaf nodes
   16/3 = 5 non-leaf nodes
   5/3 = 1 root node
   Maximum height is 5

4. Insert: 106, 115, 916, 0, 96, 126, 16, 15, 31

   H(106) = 106 = 01101010
   H(115) = 115 = 01110011
   H(916) = 148 = 10010100
   H(0) = 0 = 00000000
   H(96) = 96 = 01100000
   H(126) = 126 = 01111110
   H(16) = 16 = 00010000
   H(15) = 15 = 00001111
   H(31) = 31 = 00011111


0000
0001
0010
0011
0100
0101
0110
i=4
0111
1000
1001
1010
1011
1100
1101
1110
1111
0
15
i=4
16
31
i=4
106
96
i=4
115
126
i=4
916
i=1

CS143 Exam Problems

1. R: 100 blocks S: 95 blocks
2. n: 100
3. a. 11 nodes

   b. 4 IOs
4. 503 IOs
5. 320 IOs, in this case it is not worthwhile to contruct the index.