

Problem Set 3B
Joel Huang 100230

Title: **kd Tree**

Q3. [10 points] Familiarize yourself with the kd Tree code given out in the starter code. Try to increase the dimensionality from 2 to $k > 2$, for example 3 or 4. Please answer (briefly) the following questions: (please submit your answers in a pdf file with the rest of your answers)

What is the complexity of the find Nearest Neighbour algorithm?

What would be some good applications of the kd tree?

- i. $O(\lg n)$
- ii. The kd tree can be used for:
 - a. Querying databases using multi-dimensional keys.
 - b. Color picking for 256 colors (using RGB values): construct a kd tree to divide the space containing colors in an image, and the average of the RGB values in the 256 partitions can re-create a 256-color palette.

Title: **AVL Tree**

Q4. [10 points] Familiarize yourself with the AVL Tree code given out in the starter code. Try to get an estimate for its performance by increasing the size of the tree in terms of n , the number of keys stored in the tree. Please answer (briefly) the following questions: (submit in a pdf file)

What is the time complexity of the insert algorithm?

What would be some good applications of the AVL tree?

- i. $O(\lg n)$
- ii. Usage in databases where insertion and deletion is not frequent as compared to searching. This is due to the high cost of rotation while maintaining the AVL property/balance.

Title: **B Tree**

Q5. [10 points] Familiarize yourself with the B Tree code given out in the starter code. Try to vary the size and dimensionality of the B-Tree. Please answer (briefly) in a pdf file, the following:

i) What is the time complexity of the insert algorithm as a function of k , the dimensionality of the B-Tree?

ii) What would be some good applications of the B tree? If SSD RAM were to become the norm in laptops and notebooks, would we still need the B tree? Explain your answer briefly.

- i. $O(k \log_k n)$
- ii. B trees can be used in dictionaries and search engines. Even if SSD RAM becomes the norm in laptops and notebooks, B trees still find their use in database structures such as in MySQL.