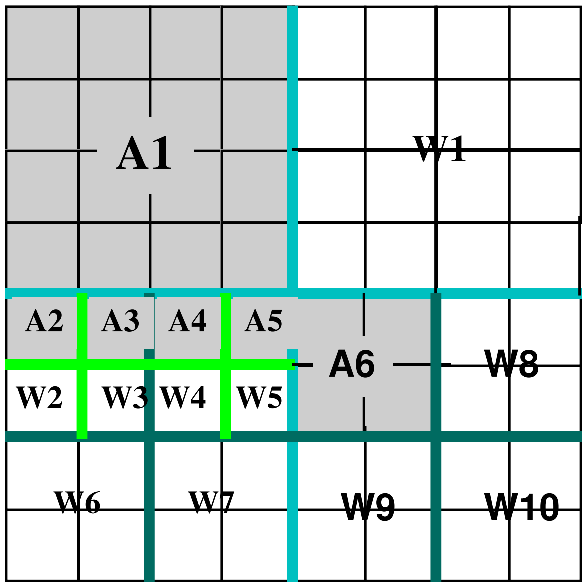
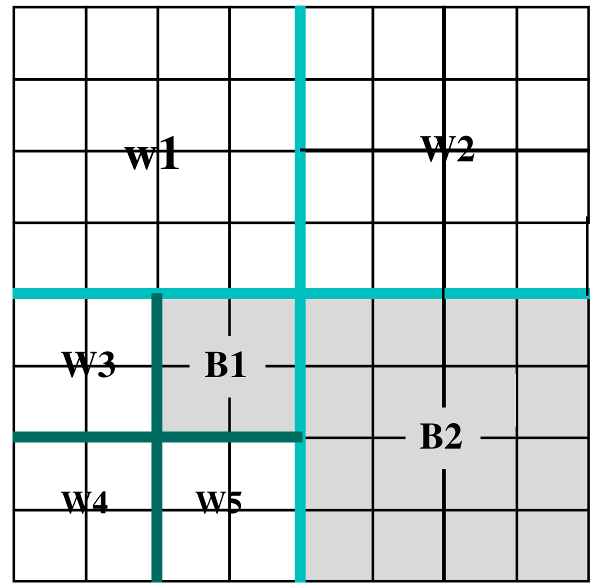
CMSC 420 - Test 2

A



B



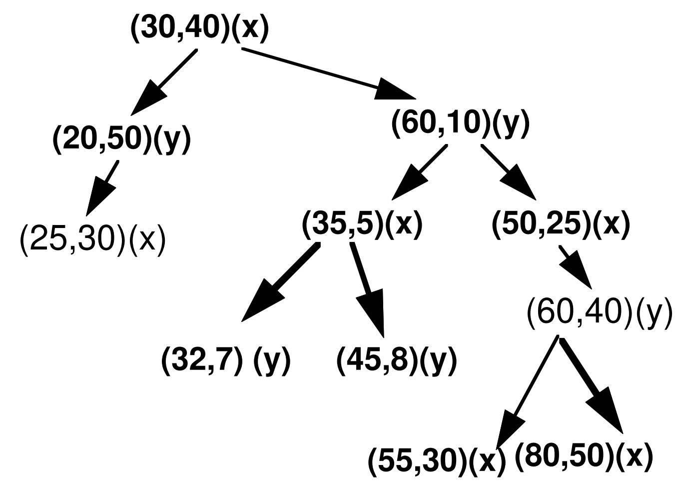
1. Region quadtrees [30]

a. Draw the region quadtree of the set corresponding to B-A (remember that given two sets X and Y the set X-Y is the set of all points in X that are **not** in Y)(5)
b. Given the (x,y) coordinates of a cell in an array, how do you construct its Morton code? (5)
c. What are the Morton codes of the blocks contained in B-A (just the region blocks, not the background blocks) (5)
d. Provide an algorithm for computing the set difference between two region quadtrees. (15)

2. k-d trees [40]

a. Show the tree that results from the insertion of the points (30,40), (40,25), (35,50), (25,80), (50,60), (10,85) into an initially empty k-d tree. (5)

b. Show the result of deleting the point (60,10) from the k-d tree shown on the right. (5)



c. Suppose that you are given a database of points to be inserted into a k-d tree. Explain how you could preprocess this set to determine an order for inserting these points into an initially empty tree that would result in a well-balanced tree. Under what conditions can you guarantee that the resulting k-d tree would be **perfectly** balanced? (15)

d. Suppose that you want to find all of the points in a k-d tree whose x coordinates are greater than a given value, **x,** and whose y coordinates are greater than a given value, **y**. Describe an algorithm that solves this problem. (15)

3. Priority search trees [30]

a. Construct the **range tree for the x coordinates** the following point set(5):

a=(10,20), b=(15,30),c= (20, 15), d=(25,40)
e=(35,5),f= (40,55), g=(50,25), h=(65,80)

b. Construct the **priority search tree** for the same set of coordinates (10)

c. Explain, **step by step**, how this tree would be used to solve the semi-infinite range query [15,35][25, ∞]. (15)

4.