Inspira Crea Transforma

UNIVERSIDAD EAFIT®

COLLISION BETWEEN BEES

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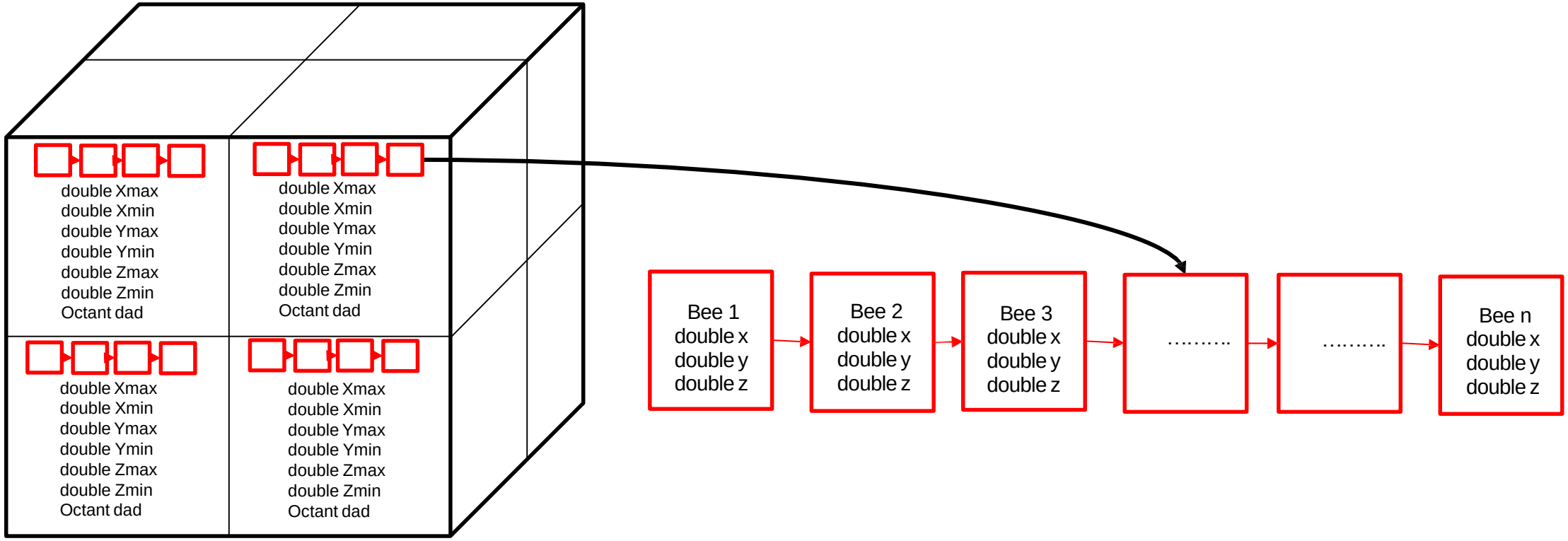
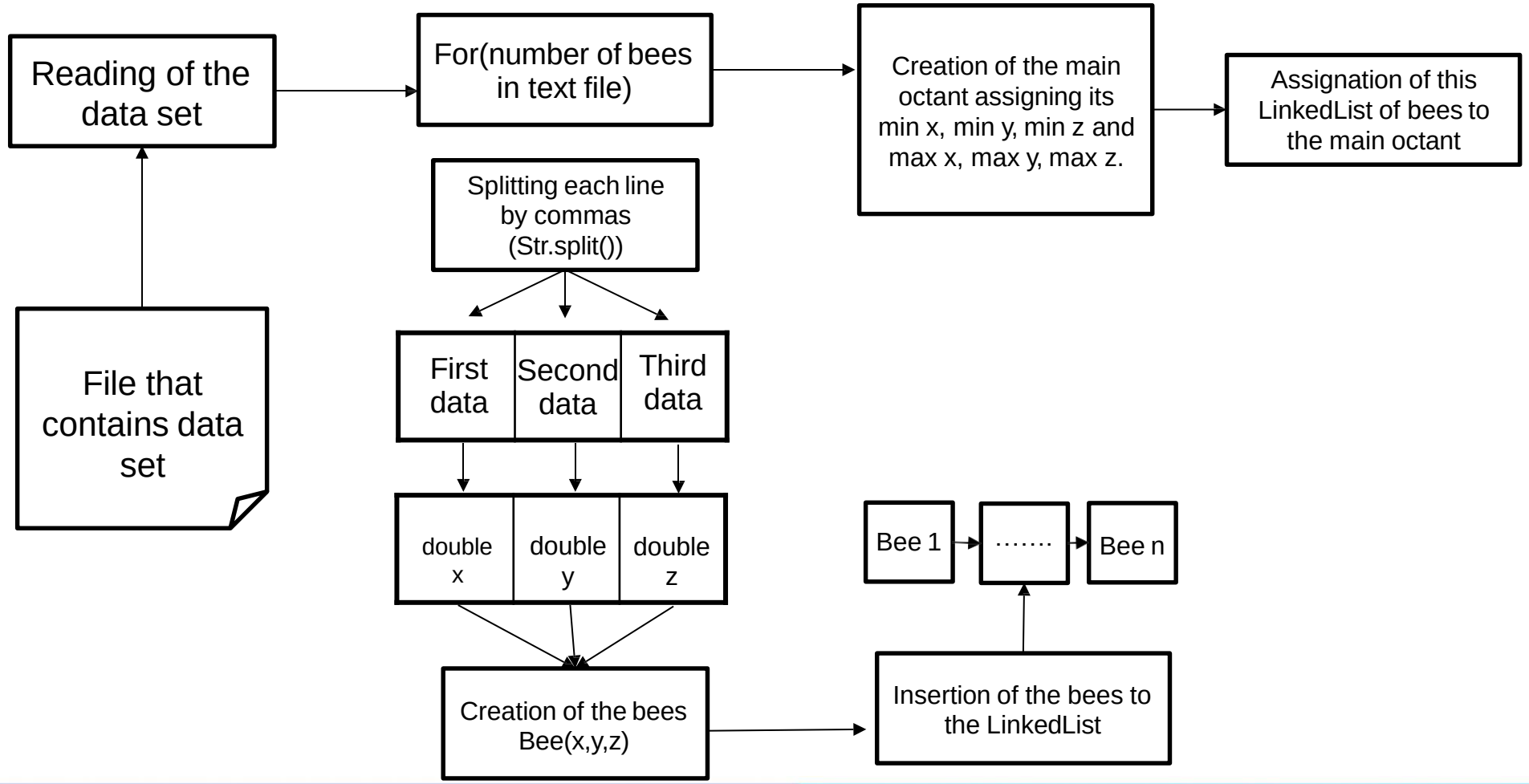
DATA STRUCTURE



OPERATIONS OF THE DATA STRUCTURE

Read and save data



OPERATIONS OF THE DATA STRUCTURE

Detecting Collisions

collisionDetector(Octant o)

Octant o

If its diagonal measures 100 or less

Else

If the size of the LinkedList of bees in this octant is bigger than 1

All the bees in this octant are in risk of collision

If the size of the LinkedList of bees in this octant is 1

Access the LinkedList of bees in the dad octant

With a for each cycle, compare the only bee in the octant with all the bees in the dad octant

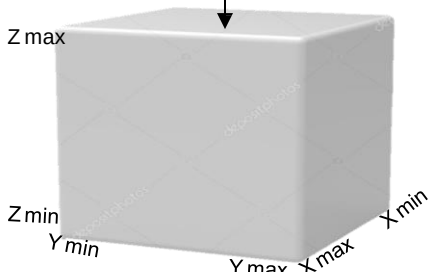
If the distance between the bee and any other bee in the dad octant is less than 100 but different than 0

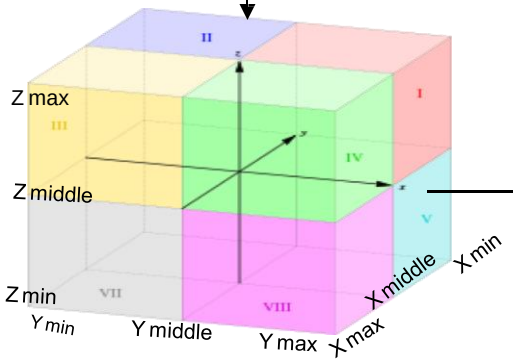
Else

The bee is in risk of collision

Break the for cycle

Creates 8 new octants





Octant o8

Octant o7

Octant o6

Octant o5

Octant o4

Octant o3

Octant o2

Octant o1

When all the bees are relocated in the 8 new octants:

With a for each cycle, the bees in the octant are visited and according to their coordinates, they are inserted in the corresponding new octant's LinkedList of bees

WHY OUR DATA STRUCTURE IS THE IDEAL?

We decided to implement this data structure since it is not difficult to interpret and understand; we think it is a very useful data structure for what we want to achieve. It works well and the complexity of its methods are O(n) and O(n*x), which allows it to be fast in its execution.

Method	Complexity
readAndSaveData()	O(n)
collisionDetector()	O(n*x)

n = number of bees
x = larger number between the longitude, latitude and height of the space were the bees are located in.
Time complexity:
T(n*x)=8n*T(x/8)+c. However, this equation in big O notation equals O(n*x).

The time complexity of detecting collisions not only depends on the number of bees, but also on how big the space were the bees are located is.

TIME CONSUMPTION

Time consumption in detecting collisions between bees in Colombia:

Number of bees in data set	Average time (ms)	Maximum time (ms)	Minimum time (ms)
15	0	1	0
150	1	5	0
1,500	25	114	2
15,000	333	1180	19
150,000	1326	3817	286
1,500,000	6477	50423	1668

Time consumption in detecting collisions between bees in Bello:

Number of bees in data set	Average time (ms)	Maximum time (ms)	Minimum time (ms)
10	0	1	0
100	1	7	0
1,000	16	53	1
10,000	204	411	13
100,000	654	2068	109
1,000,000	5521	19101	599

MEMORY CONSUMPTION

Memory consumption in detecting collisions between bees in Colombia:

Number of bees in data set	Average memory consumption (bytes)	Maximum memory consumption (bytes)	Minimum memory consumption (bytes)
15	1581889	2268224	1501800
150	2319488	3328800	1444976
1,500	13587445	23506208	3787488
15,000	125064289	226554160	24661424
150,000	290214425	501598064	34990000
1,500,000	864622235	1079491184	577702712

Memory consumption in detecting collisions between bees in Bello:

Number of bees in data set	Average memory consumption (bytes)	Maximum memory consumption (bytes)	Minimum memory consumption (bytes)
10	1506222	2176096	1433072
100	2073384	2866976	1558168
1,000	10130280	16733168	2909576
10,000	83864497	153037704	18197352
100,000	257127238	391560296	12917168
1,000,000	676561120	998138408	188690616