

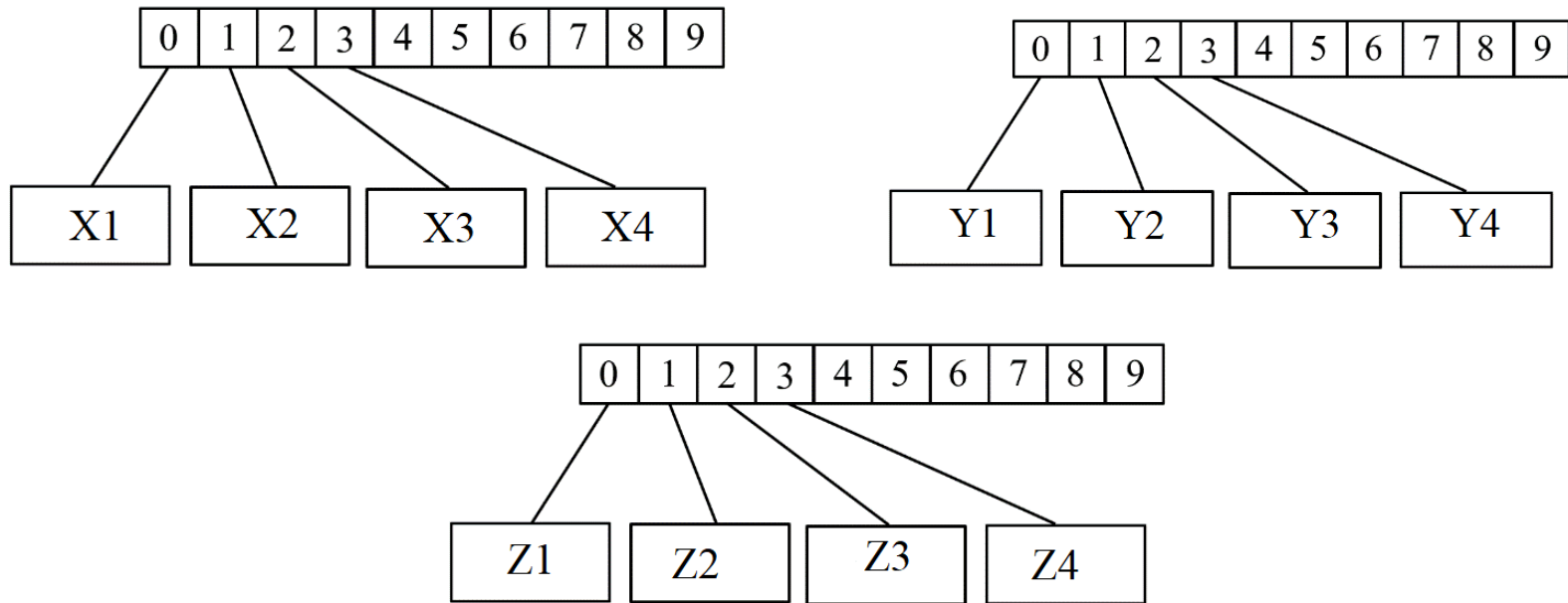
TECHNOLOGY AND ALGORITHMS: A SOLUTION TO BEE´S EXTINTION

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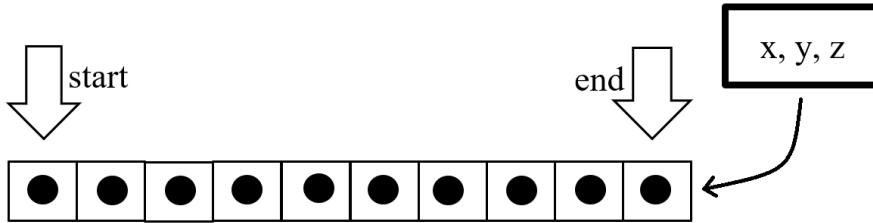
Medellín, Date of the oral presentation

Estructuras de Datos Diseñada

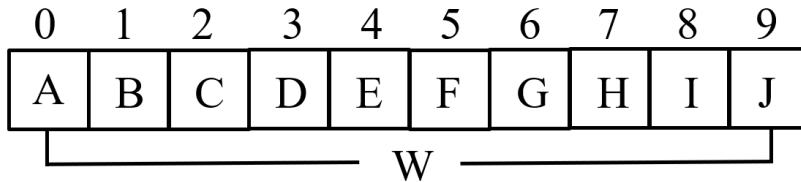


Graphic 1: ArrayList of bee's coordinates. A coordinate is double number that represent the latitude, longitude or height.

Data Structure Operations



Graphic 2: Add operation of ArrayLists.



W.get (7) → A

Graphic 3: Get operation of ArrayLists.

Complexity table

Method	Complexity
Add	$O(1)$
Remove	$O(n/2)$
Get	$O(1)$

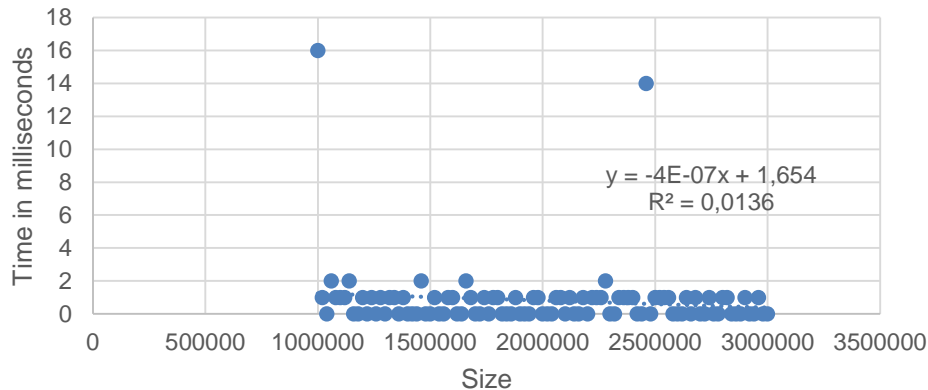
Table 1: Complexity of the operations of ArrayLists.

Design Criteria of the Data Structure

- To solve the problem it was necessary to test it with groups of data of different sizes, that is to say that this was not a constant factor.
- The data structure used should be one to which you could add many data and obtain each of its specifications (length, latitude, height).
- The add and get operation in an ArrayList have time complexity of $O(1)$, so they were very efficient no matter the size of the data.

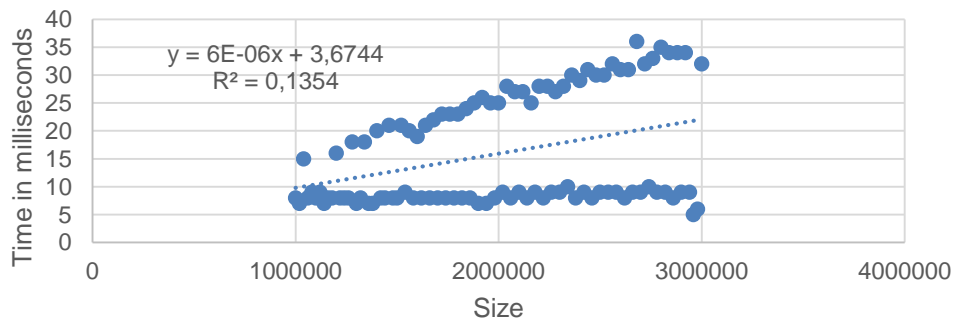
Time and Memory Consumption

Execution time for add operation in a group of 10 bees



Graphic 4, 5: Time execution for add operation in ArrayLists of different lengths.

Execution time for add operation in a group of 1000 bees



Implementation

BlueJ: Terminal Window - Proyecto

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Options
Bee #: 843 and bee #: 819 are at 40.2327670198175m.
Bee #: 845 and bee #: 116 are at 88.06367822062113m.
Bee #: 846 and bee #: 768 are at 92.99982299169771m.
Bee #: 848 and bee #: 440 are at 76.3727443734645m.
Bee #: 849 and bee #: 70 are at 85.7560004773296m.
Bee #: 849 and bee #: 108 are at 68.60941353320989m.
Bee #: 849 and bee #: 725 are at 89.47323689022875m.
Bee #: 852 and bee #: 204 are at 71.97884761391614m.
Bee #: 854 and bee #: 638 are at 72.20031922244362m.
Bee #: 855 and bee #: 391 are at 74.72512944907066m.
Bee #: 856 and bee #: 116 are at 61.443195134112386m.
Bee #: 856 and bee #: 272 are at 79.29003380263408m.
Bee #: 856 and bee #: 329 are at 64.64122070187669m.
Bee #: 857 and bee #: 748 are at 49.76152960864728m.
Bee #: 858 and bee #: 590 are at 87.9072009719801m.
Bee #: 860 and bee #: 51 are at 93.59990126039007m.
Bee #: 860 and bee #: 168 are at 56.960815538626875m.
Bee #: 860 and bee #: 414 are at 81.91607565778904m.
Bee #: 860 and bee #: 485 are at 34.240154413326245m.
Bee #: 861 and bee #: 492 are at 93.67969884150685m.
Bee #: 861 and bee #: 739 are at 82.24945851829432m.
Bee #: 862 and bee #: 88 are at 32.31334712961388m.
Bee #: 863 and bee #: 723 are at 94.4272192994596m.
Bee #: 864 and bee #: 78 are at 42.34748724724821m.
Bee #: 864 and bee #: 767 are at 24.826463359527814m.
Bee #: 865 and bee #: 639 are at 90.25544748609497m.
Bee #: 866 and bee #: 700 are at 68.82400382568973m.
Bee #: 867 and bee #: 77 are at 84.80392583858894m.
Bee #: 867 and bee #: 693 are at 71.83249582620837m.
Bee #: 868 and bee #: 103 are at 49.80392966295498m.
Bee #: 868 and bee #: 789 are at 68.9692945953118m.
Bee #: 873 and bee #: 101 are at 91.72776764612945m.
Bee #: 873 and bee #: 481 are at 86.54246034081253m.
Bee #: 873 and bee #: 696 are at 59.49051907543509m.
Can only enter input while your programming is running
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Graphic 5: Bees that are less than 100m.