**Homework 2**

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**Abstract**

In this paper, we explore how different representations on a Genetic Algorithm (GA) can affect its performance.

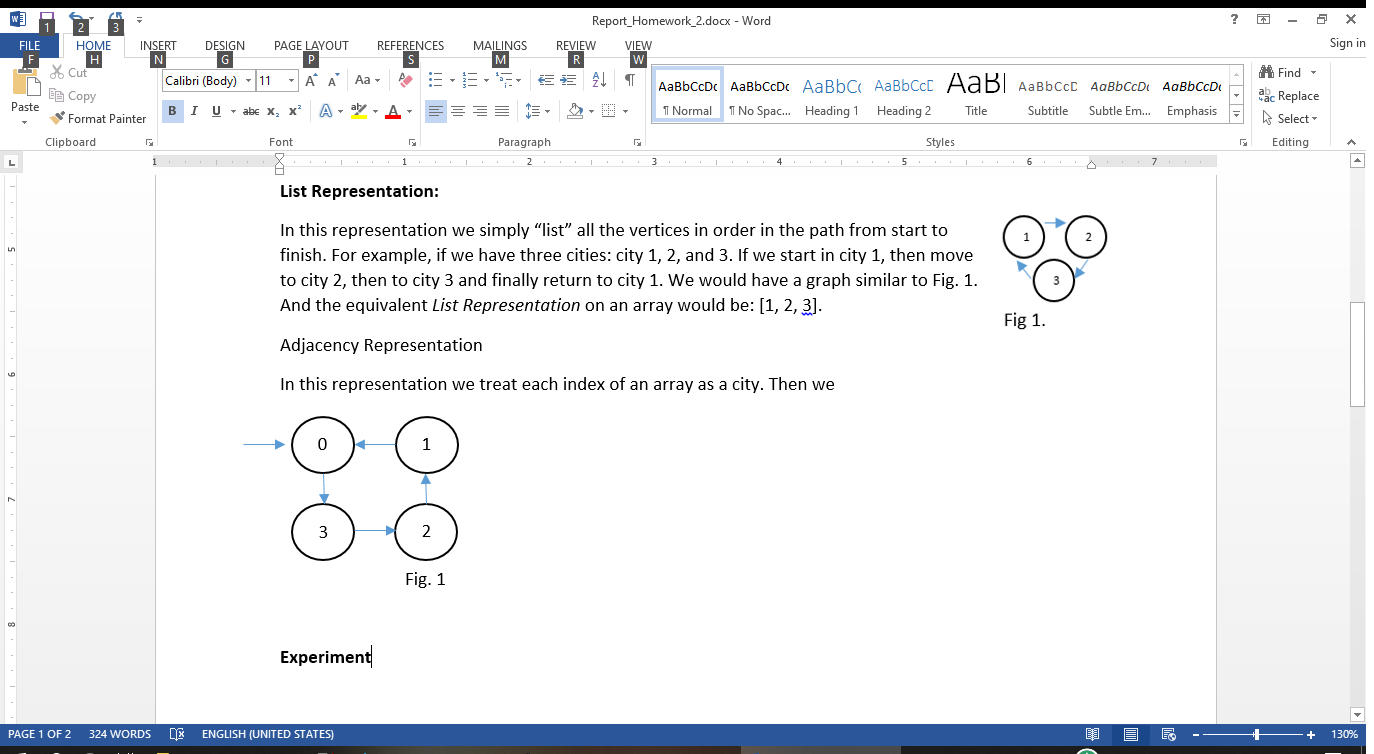
**Introduction**

To test the importance of choosing the correct representation to a problem intended to be solved with a GA, we first start by finding a suitable problem. The problem assigned by our professor Annie Wu [1] was the famous Traveling Salesman Problem or TSP for short. Then we were allowed to choose two different representations: List and Adjacency were the representations we decided to use for this project.

**Traveling Salesman Problem (TSP) review:**

Given a number of cities n, find a path that goes through all the cities exactly one time and ends in the first city.

**List Representation:**

In this representation we simply “list” all the vertices in order in the path from start to finish. For example, if we have four cities: city 0, 1, 2, and 3. If we start in city 0, then move to city 3, then to city 2, then 1, and finally return to city 0. We would have a graph similar to Fig. 1. And the equivalent *List Representation* on an array would be: [0, 3, 2, 1, 0]. But since we always return to the city we started, we can omit the last 0, leaving us with this array: [0, 3, 2, 1].

**Adjacency Representation:**

In this representation we treat each index of an array as a city. Then the integer stored in each given index is the city after the city. So for the same example in Fig. 1 used in the List Representation, our array would look like this: [3, 0, 1, 2].

**Experiment**

**Results**

By looking at the graph on image 1…

**Conclusion**

In conclusion, we found out that using different representations…

**Extensions**

By only testing the GA on the traveling salesman problem and only using two representations, we limit the generality of the results. To solidify our results we would need to: Experiment in a bigger range of problems. And expand the number of representations per problem.

**References**

[1] Hal Stringer & Annie Wu (2004). “A Teaching GA” [Computer software]. Florida, Orlando: UCF.

[2] Applegate, D. L.; Bixby, R. M.; Chvatal, V.; Cook, W. J. (2006), “The Traveling Salesman Problem”, ISBN 978-0-691-12993-8.