

# CSS 534 Program 5 Report

Nick Rohde

11<sup>th</sup> of December 2018

## Contents

<b>1</b>	<b>Overview</b>	<b>2</b>
<b>2</b>	<b>Discussion</b>	<b>2</b>
<b>3</b>	<b>Analysis</b>	<b>2</b>
<b>4</b>	<b>Source Code</b>	<b>3</b>
4.1	Program 5 . . . . .	3
4.2	Laboratory 5 . . . . .	3
<b>5</b>	<b>Output</b>	<b>3</b>
5.1	Program 5 . . . . .	3
5.2	Laboratory 5 . . . . .	4

# 1 Overview

# 2 Discussion

# 3 Analysis

Table 1: Comparison of Computation for MPI

# Nodes	Average Execution Time (s) <sup>†</sup>	Performance Improvement
1	32.8419	N/A
2	16.0231	2.050
4	7.2312	4.542

<sup>†</sup> Average over 100 trials

Table 2: Comparison of Computation for Spark

# Nodes	#Cores	Execution Time	Performance Improvement
1	1	160.843	N/A
1	2	113.404	1.418
1	3	77.057	2.087
2	2	92.786	1.733
2	4	60.676	2.650
2	6	45.464	3.537
4	4	68.041	2.363
4	8	41.378	3.887
4	12	45.328	3.548

## 4 Source Code

### 4.1 Program 5

The source code for Program 5 can also be found in the included src.zip folder.

---

### 4.2 Laboratory 5

The source code for laboratory 5 #TODO

---

## 5 Output

This section provides the output generated by program 5 #TODO

### 5.1 Program 5

Performance: 1 compute node, 1 core: 457 seconds.

4 compute nodes, 5 cores: 193 seconds.

Improvement:  $\frac{457}{193} \approx 2.368$  times.

---

```
/** Sequential Program **/  
java SA 1000000 ../input_files/cities.txt  
Best solution found:path: 21 -> 27 -> 24 -> 25 -> 7 -> 31 -> 2 -> 22 -> 18 -> 12 -> 15 -> 28 -> 26  
-> 4 -> 20 -> 9 -> 32 -> 14 -> 8 -> 34 -> 30 -> 19 -> 13 -> 23 -> 6 -> 10 -> 35 -> 5 -> 0 ->  
11 -> 33 -> 17 -> 29 -> 3 -> 1 -> 16 | distance: 447.38786463942176  
Elapsed time:11409 ms.
```

```
-----  
  
/** MPI Program **/  
run_mpi 4 Runner 2000000 ../input_files/cities.txt  
Solution is:path: 21 -> 27 -> 24 -> 25 -> 7 -> 31 -> 2 -> 22 -> 18 -> 12 -> 15 -> 28 -> 26 -> 4 ->  
20 -> 9 -> 32 -> 14 -> 8 -> 34 -> 30 -> 19 -> 13 -> 23 -> 6 -> 10 -> 35 -> 5 -> 0 -> 11 -> 33  
-> 17 -> 29 -> 3 -> 1 -> 16 | distance: 447.38786463942176  
Execution time: 7898 ms.
```

```
-----  
  
/** MapReduce Program **/  
  
-----
```

```
/** Spark Program **/  
spark-submit --class uwb.css534.prog5.App --master "spark://cssmpi1.uwb.edu:60007"  
--total-executor-cores 12 sa-tsp-spark-1.0-SNAPSHOT.jar 2000000  
CSS534_Program5/code/input_files/cities.txt 12
```

```
Best solution found:path: 21 -> 27 -> 24 -> 25 -> 7 -> 31 -> 2 -> 22 -> 18 -> 12 -> 15 -> 28 -> 26  
-> 4 -> 20 -> 9 -> 32 -> 14 -> 8 -> 34 -> 30 -> 19 -> 13 -> 23 -> 6 -> 10 -> 35 -> 5 -> 0 ->  
11 -> 33 -> 17 -> 29 -> 3 -> 1 -> 16 | distance: 447.38786463942176  
Elapsed time:15438 ms.
```

```
spark-submit --class uwb.css534.prog5.App --master "spark://cssmpi1.uwb.edu:60007"  
--total-executor-cores 12 sa-tsp-spark-1.0-SNAPSHOT.jar 10000000  
CSS534_Program5/code/input_files/cities.txt 100  
Best solution found:path: 21 -> 27 -> 24 -> 25 -> 7 -> 31 -> 2 -> 22 -> 18 -> 12 -> 15 -> 28 -> 26  
-> 4 -> 20 -> 9 -> 32 -> 14 -> 8 -> 34 -> 30 -> 19 -> 13 -> 23 -> 6 -> 10 -> 35 -> 5 -> 0 ->  
11 -> 33 -> 17 -> 29 -> 3 -> 1 -> 16 | distance: 447.38786463942176  
Elapsed time:29135 ms.
```

```
-----  
/** MASS Program **/  
-----
```

---

## 5.2 Laboratory 5

---