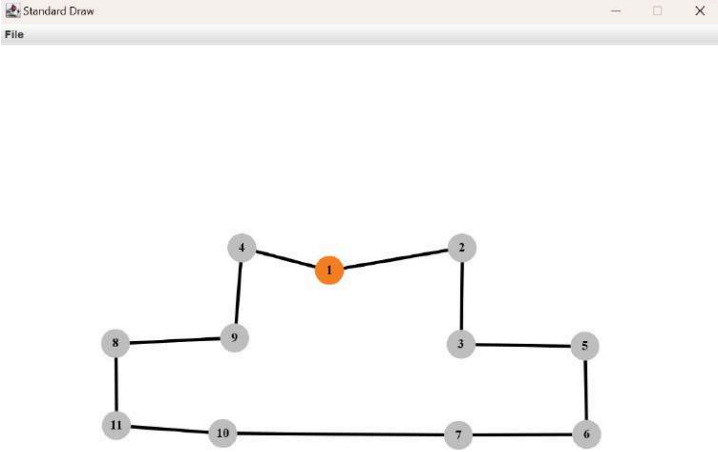


# REPORT: Mehmet Can Gürbüz

## Input File 1:

- Brute Force Method :



Run MehmetCanGurbuz x

File

```
C:\Users\mehme\.jdk\openjdk-21.0.2\bin\java.exe -Duser.language=us -Duser.country=US "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.4\lib\idea_rt.jar=57777:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.4\bin" -Dfile.encoding=UTF-8 -Dsun.stdout.encoding=UTF-8 -Dsun.stderr.encoding=UTF-8 -classpath C:\Users\mehme\IdeaProjects\HW1\out\production\HW1;C:\Users\mehme\Downloads\stdlib.jar MehmetCanGurbuz
```

Method: Brute-Force Method

Shortest Distance: 1.7952913856772432

Shortest Route: [1, 4, 9, 8, 11, 10, 7, 6, 5, 3, 2, 1]

Time it takes to find the shortest path: 1.092 seconds

Process finished with exit code 0

src > MehmetCanGurbuz.java > MehmetCanGurbuz > main 16:29 CRLF UTF-8 4 spaces

- Ant Colony Optimization Method:
- Constants:

*MAX\_ITERATIONS* = 500

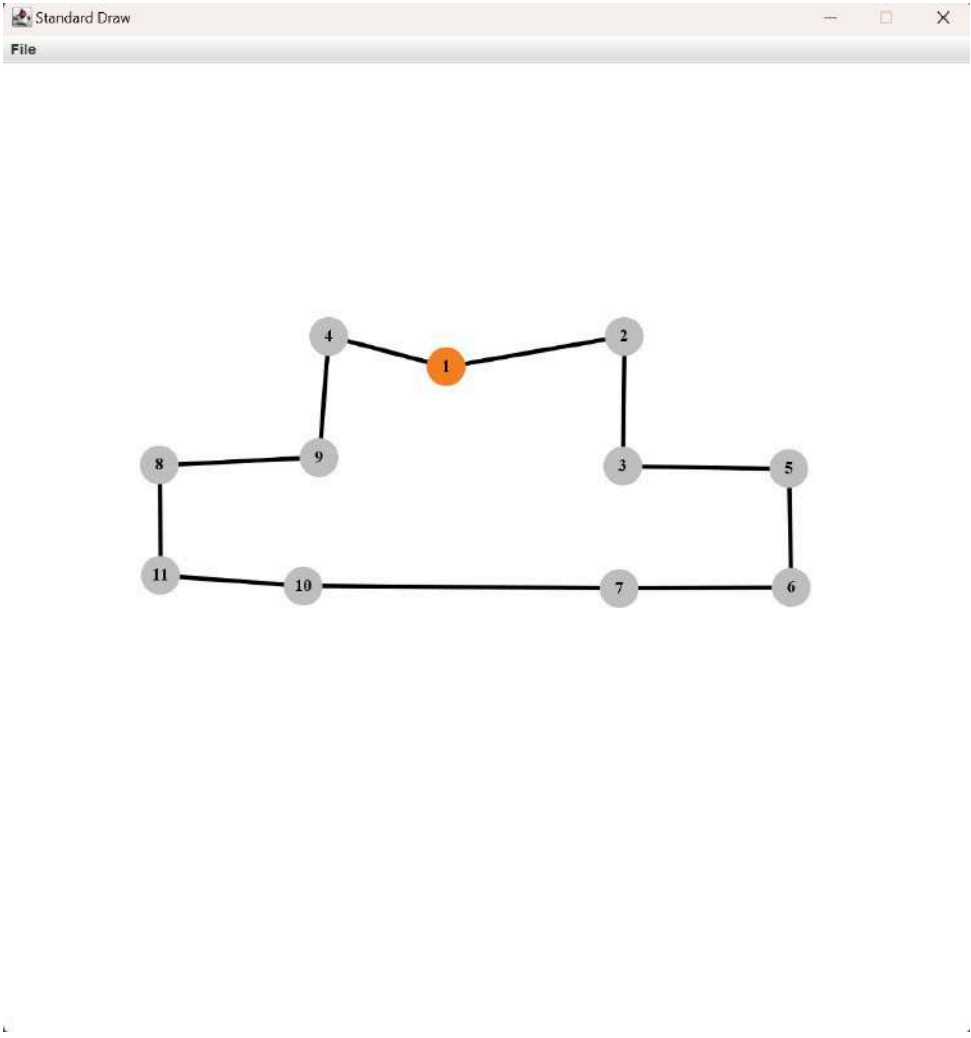
*NUM\_ANTS* = 50

*ALPHA* = 0.7

*BETA* = 2.5

*DEG* = 0.6

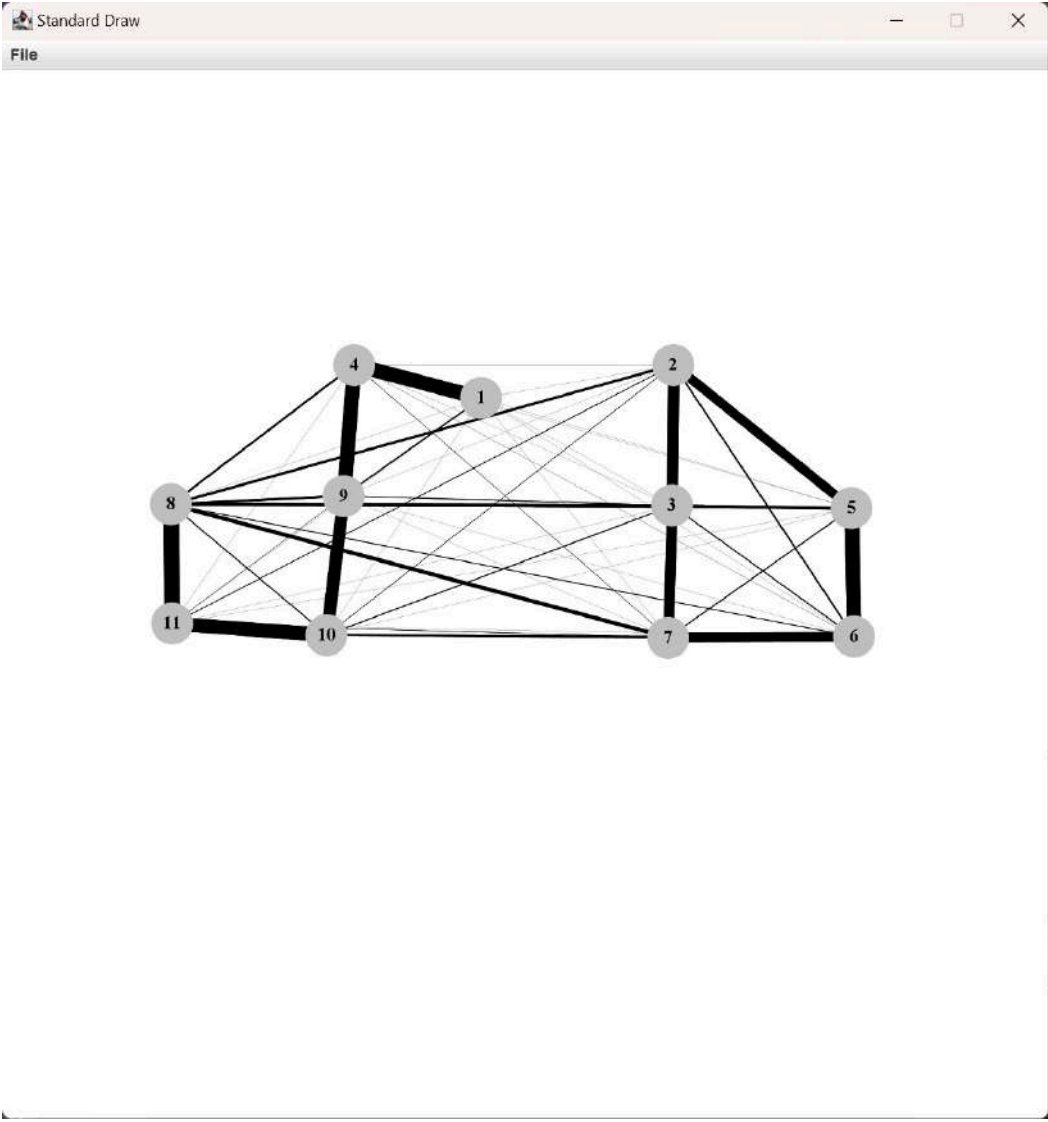
*Q* = 0.0001



```
Run MehmetCanGurbuz x
C:\Users\mehme\.jdk\openjdk-21.0.2\bin\java.exe -Duser.language=us -Duser.country=US "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.4\lib\idea_rt
.jar=57794:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.4\bin" -Dfile.encoding=UTF-8 -Dsun.stdout.encoding=UTF-8 -Dsun.stderr.encoding=UTF-8 -classpath
C:\Users\mehme\IdeaProjects\HW1\out\production\HW1;C:\Users\mehme\Downloads\stdlib.jar MehmetCanGurbuz
Method: Ant Colony Optimization
Shortest Distance: 1.7952913856772432
Shortest Route: [1 , 4 , 9 , 8 , 11 , 10 , 7 , 6 , 5 , 3 , 2 , 1]
Time it takes to find the shortest path: 0.948 seconds

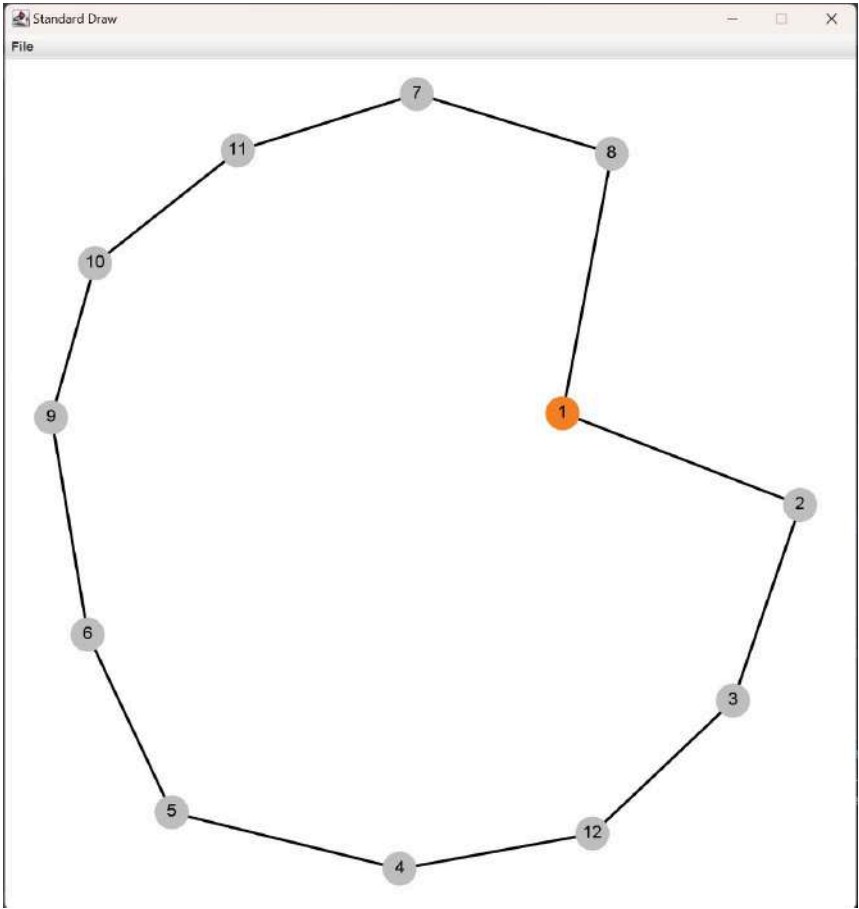
Process finished with exit code 0
```

**Pheromone Densities of inputfile01 :**



# Input File 2:

- **Brute Force Method:**



Run MehmetCanGurbuz

```
C:\Users\mehme\.jdk\openjdk-21.0.2\bin\java.exe -Duser.language=us -Duser.country=US "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.4\lib\idea_rt.jar=57817:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.4\bin" -Dfile.encoding=UTF-8 -Dsun.stdout.encoding=UTF-8 -Dsun.stderr.encoding=UTF-8 -classpath C:\Users\mehme\IdeaProjects\HW1\out\production\HW1;C:\Users\mehme\Downloads\stdlib.jar MehmetCanGurbuz
Method: Brute-Force Method
Shortest Distance: 2.935877143237598
Shortest Route: [1, 8, 7, 11, 10, 9, 6, 5, 4, 12, 3, 2, 1]
Time it takes to find the shortest path: 3.624 seconds

Process finished with exit code 0
```

W1 > src > MehmetCanGurbuz.java > MehmetCanGurbuz > main 17:28 CRLF UTF-8 4 spaces

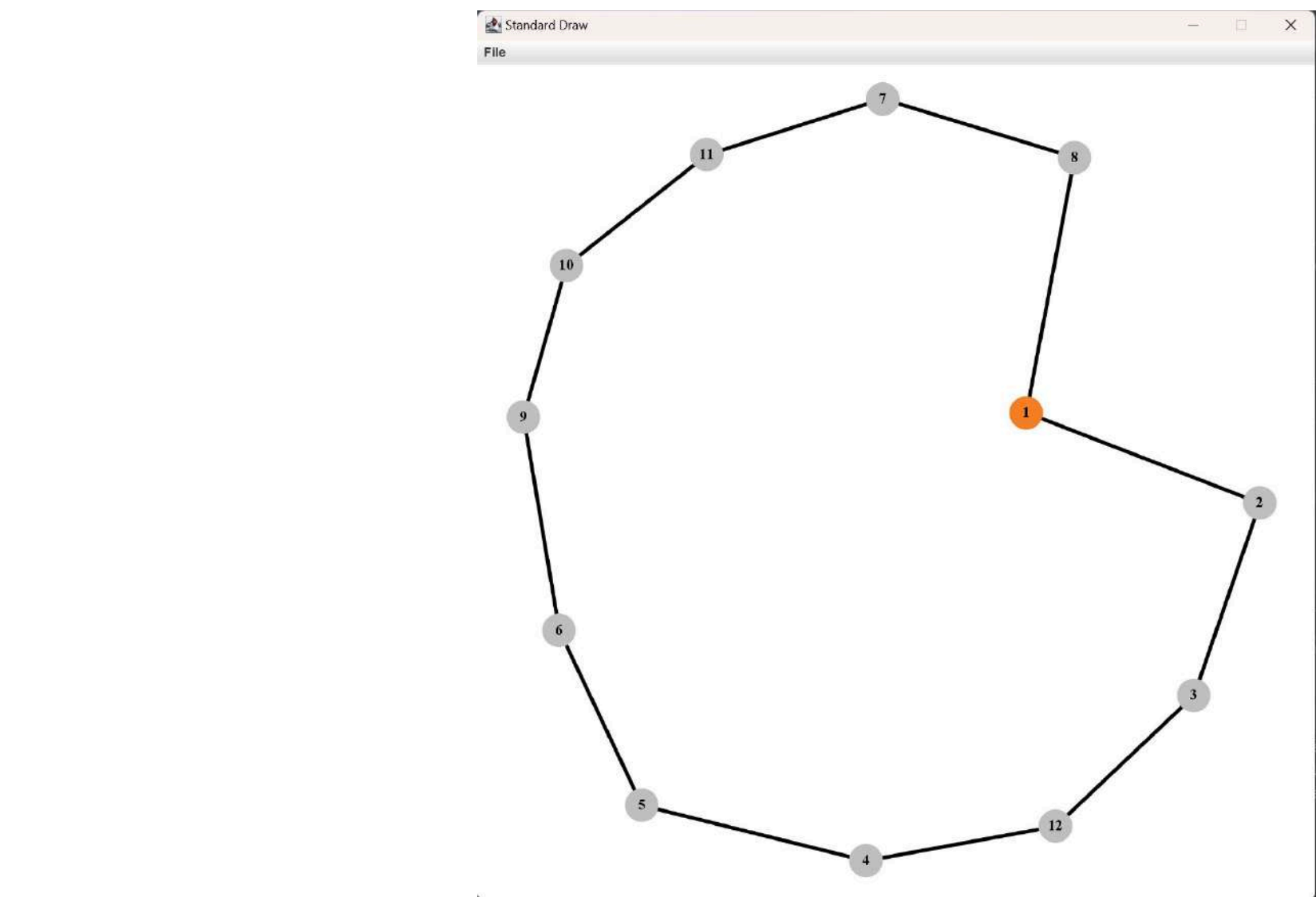
- **Ant Colony Optimization:**

- **Constants:**

***MAX\_ITERATIONS = 500***      ***NUM\_ANTS = 50***

***ALPHA = 0.7***      ***BETA = 2.5***

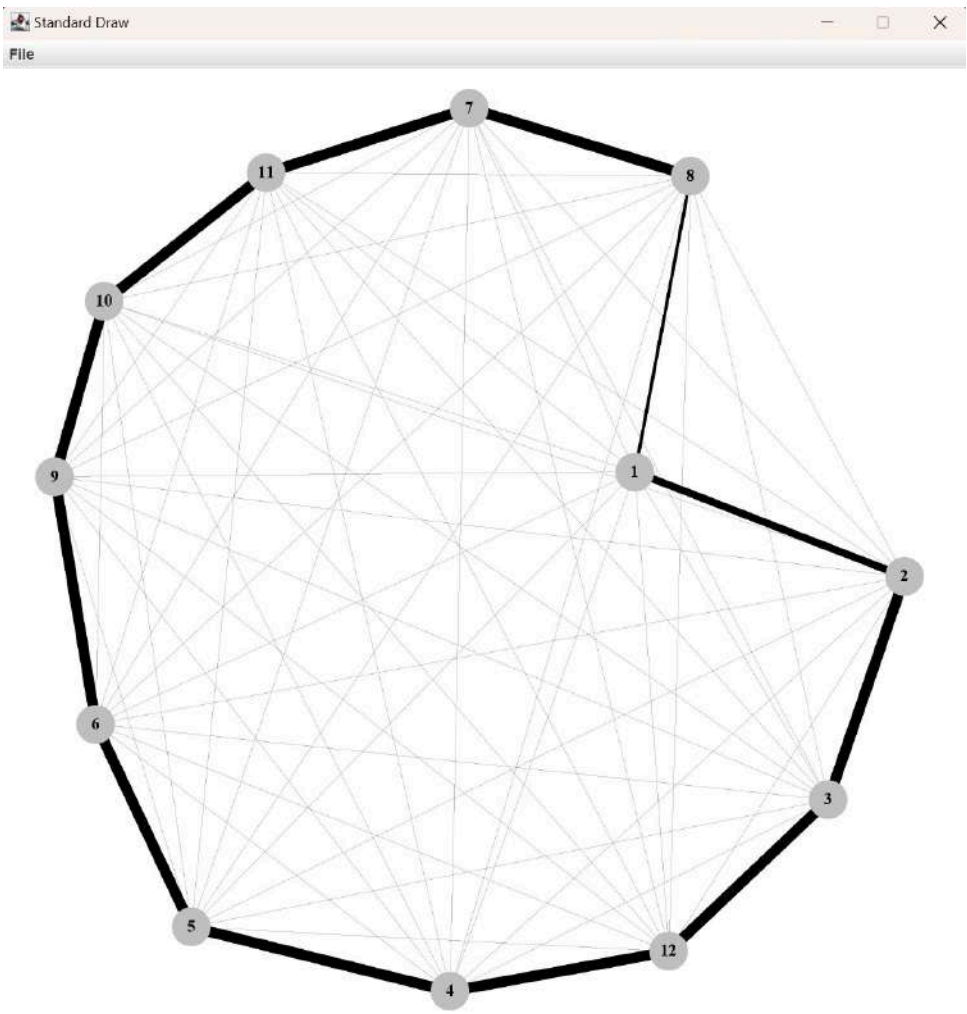
***DEG = 0.6***      ***Q = 0.0001***



```
Run MehmetCanGurbuz x
C:\Users\mehme\.jdk\openjdk-21.0.2\bin\java.exe -Duser.language=us -Duser.country=US "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.4\lib\idea_rt.jar=57833:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.4\bin" -Dfile.encoding=UTF-8 -Dsun.stdout.encoding=UTF-8 -Dsun.stderr.encoding=UTF-8 -classpath C:\Users\mehme\IdeaProjects\HW1\out\production\HW1;C:\Users\mehme\Downloads\stdlib.jar MehmetCanGurbuz
Method: Ant Colony Optimization
Shortest Distance: 2.935877143237598
Shortest Route: [1 , 8 , 7 , 11 , 10 , 9 , 6 , 5 , 4 , 12 , 3 , 2 , 1]
Time it takes to find the shortest path: 1.022 seconds

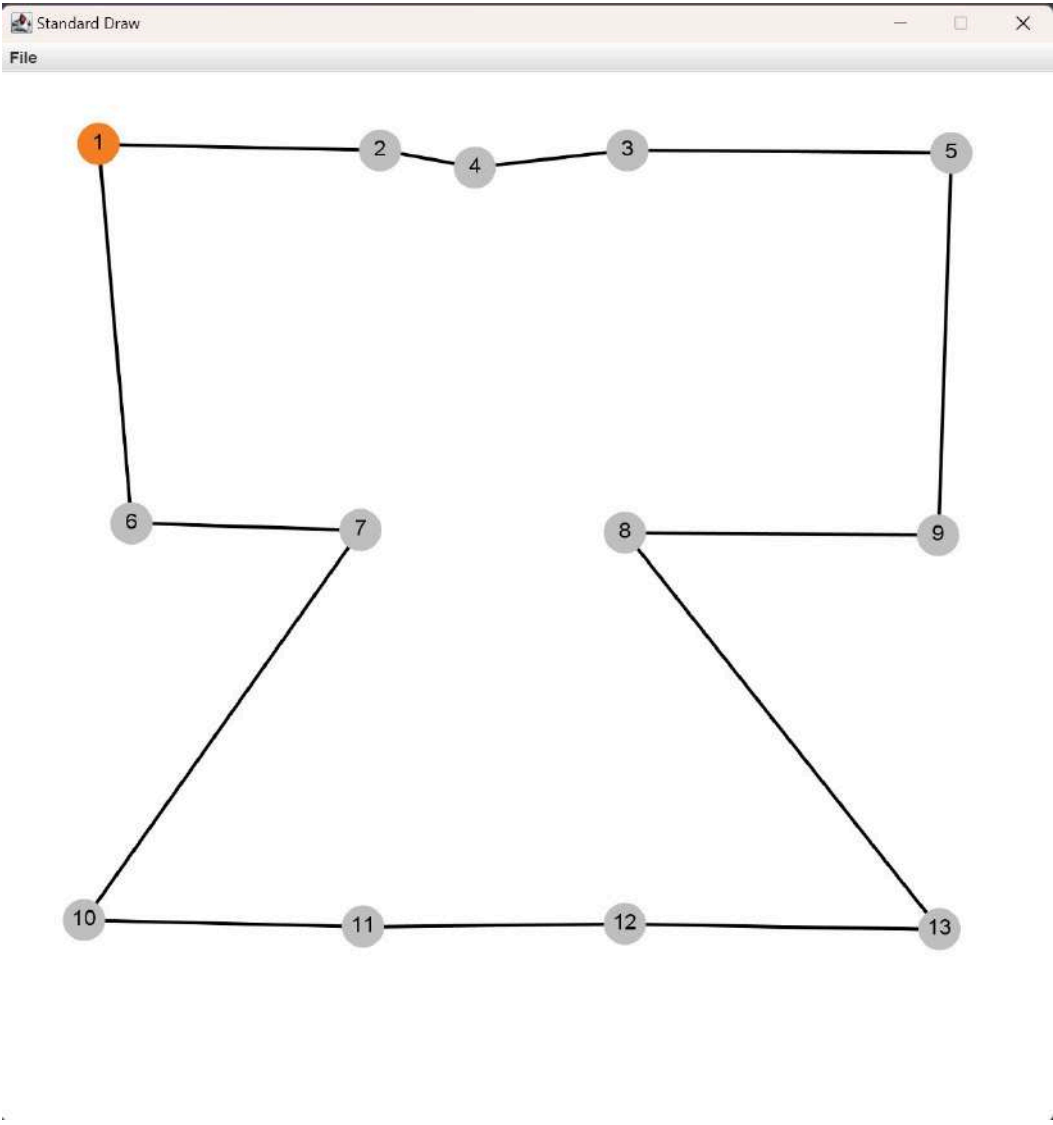
Process finished with exit code 0
```

**Pheromone Densities of inputfile02:**



# Input File 3:

- *Brute Force Method :*



Run MehmetCanGurbuz x

```
C:\Users\mehme\.jdk\openjdk-21.0.2\bin\java.exe -Duser.language=us -Duser.country=US "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.4\lib\idea_rt.jar=57865:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.4\bin" -Dfile.encoding=UTF-8 -Dsun.stdout.encoding=UTF-8 -Dsun.stderr.encoding=UTF-8 -classpath C:\Users\mehme\IdeaProjects\HW1\out\production\HW1;C:\Users\mehme\Downloads\stdlib.jar MehmetCanGurbuz
Method: Brute-Force Method
Shortest Distance: 3.802919361826042
Shortest Route: [1, 2, 4, 3, 5, 9, 8, 13, 12, 11, 10, 7, 6, 1]
Time it takes to find the shortest path: 37.618 seconds

Process finished with exit code 0
```

V1 > src > MehmetCanGurbuz.java > MehmetCanGurbuz > main 17:28 CRLF UTF-8 4 spaces

- *Ant Colony Optimization Method:*

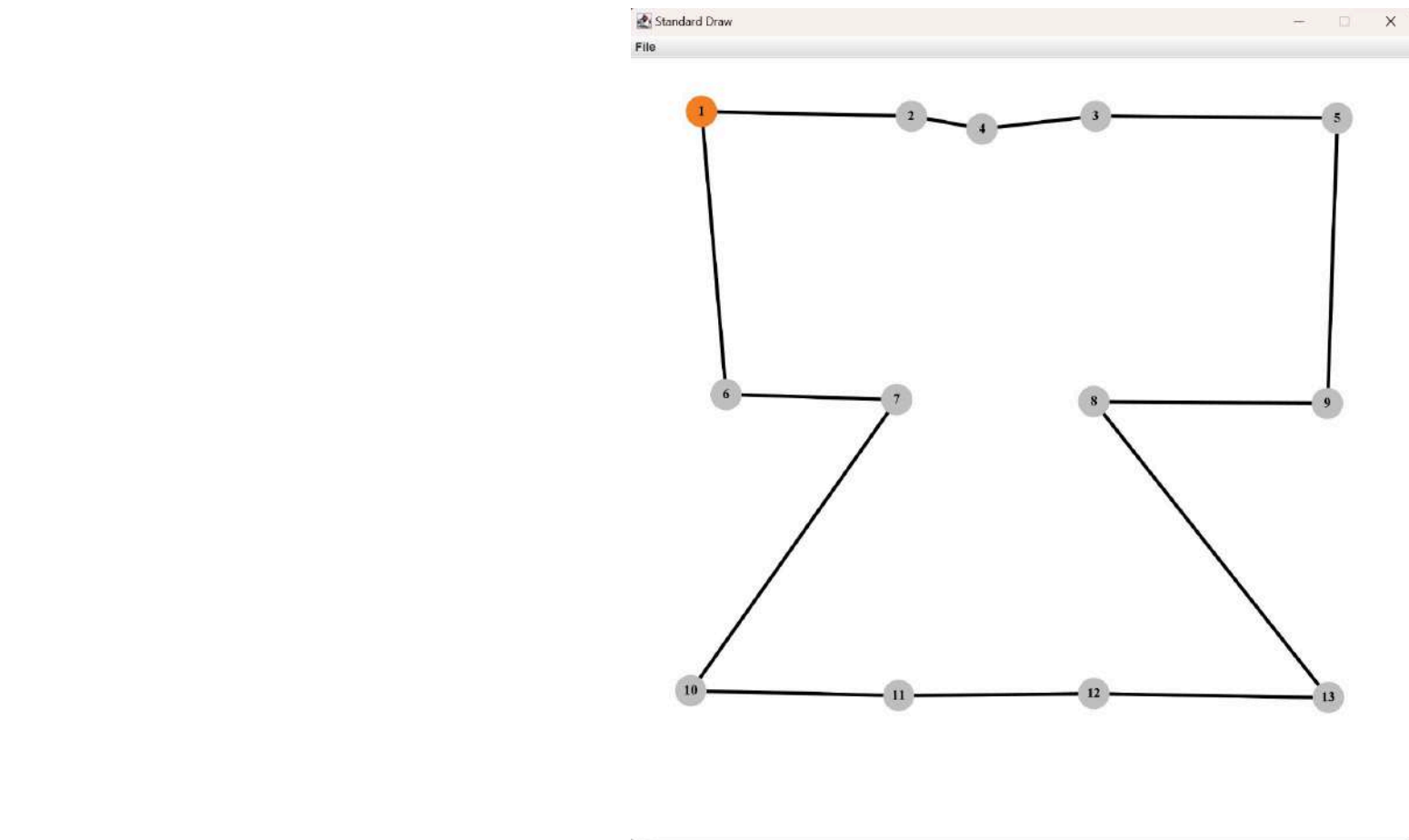
- Constants:

*MAX\_ITERATIONS* = 500      *NUM\_ANTS* = 50

*ALPHA* = 0.7      *BETA* = 2.5

*DEG* = 0.6      *Q* = 0.0001

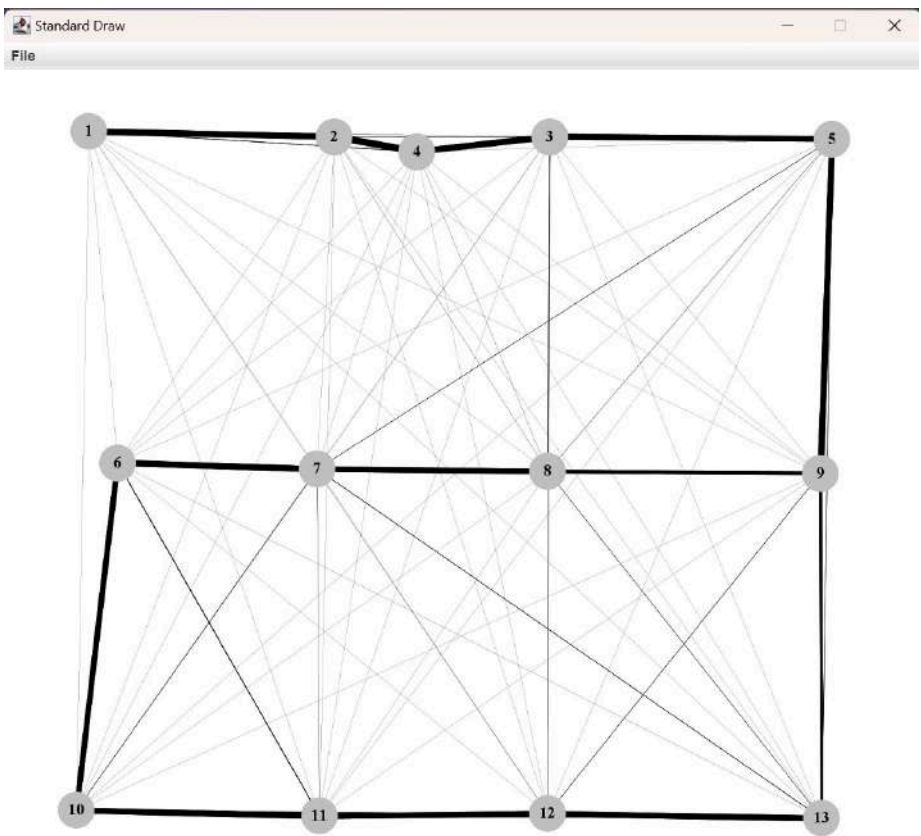




```
Run MehmetCanGurbuz x
C:\Users\mehme\.jdk\openjdk-21.0.2\bin\java.exe -Duser.language=us -Duser.country=US "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.4\lib\idea_rt.jar=57875:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.4\bin" -Dfile.encoding=UTF-8 -Dsun.stdout.encoding=UTF-8 -Dsun.stderr.encoding=UTF-8 -classpath C:\Users\mehme\IdeaProjects\HW1\out\production\HW1;C:\Users\mehme\Downloads\stdlib.jar MehmetCanGurbuz
Method: Ant Colony Optimization
Shortest Distance: 3.802919361826042
Shortest Route: [1, 2, 4, 3, 5, 9, 8, 13, 12, 11, 10, 7, 6, 1]
Time it takes to find the shortest path: 1.107 seconds

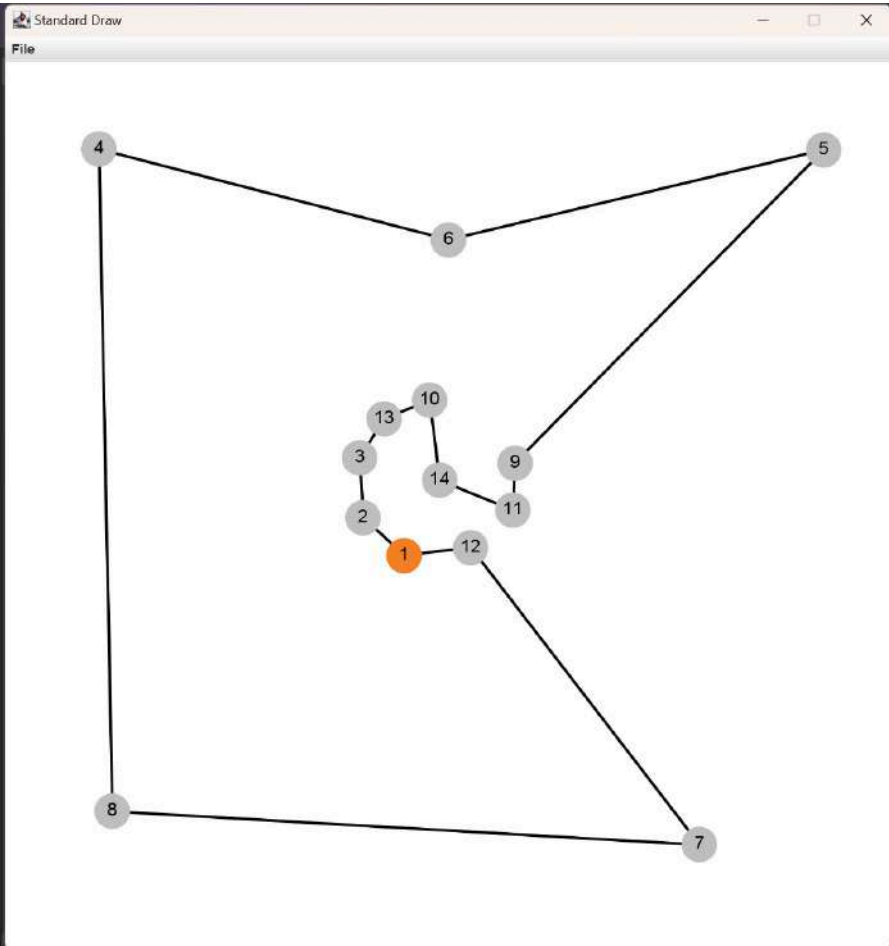
Process finished with exit code 0
```

Pheromone Densities of inputfile03 :



# Input File 4:

- *Brute Force Method:*



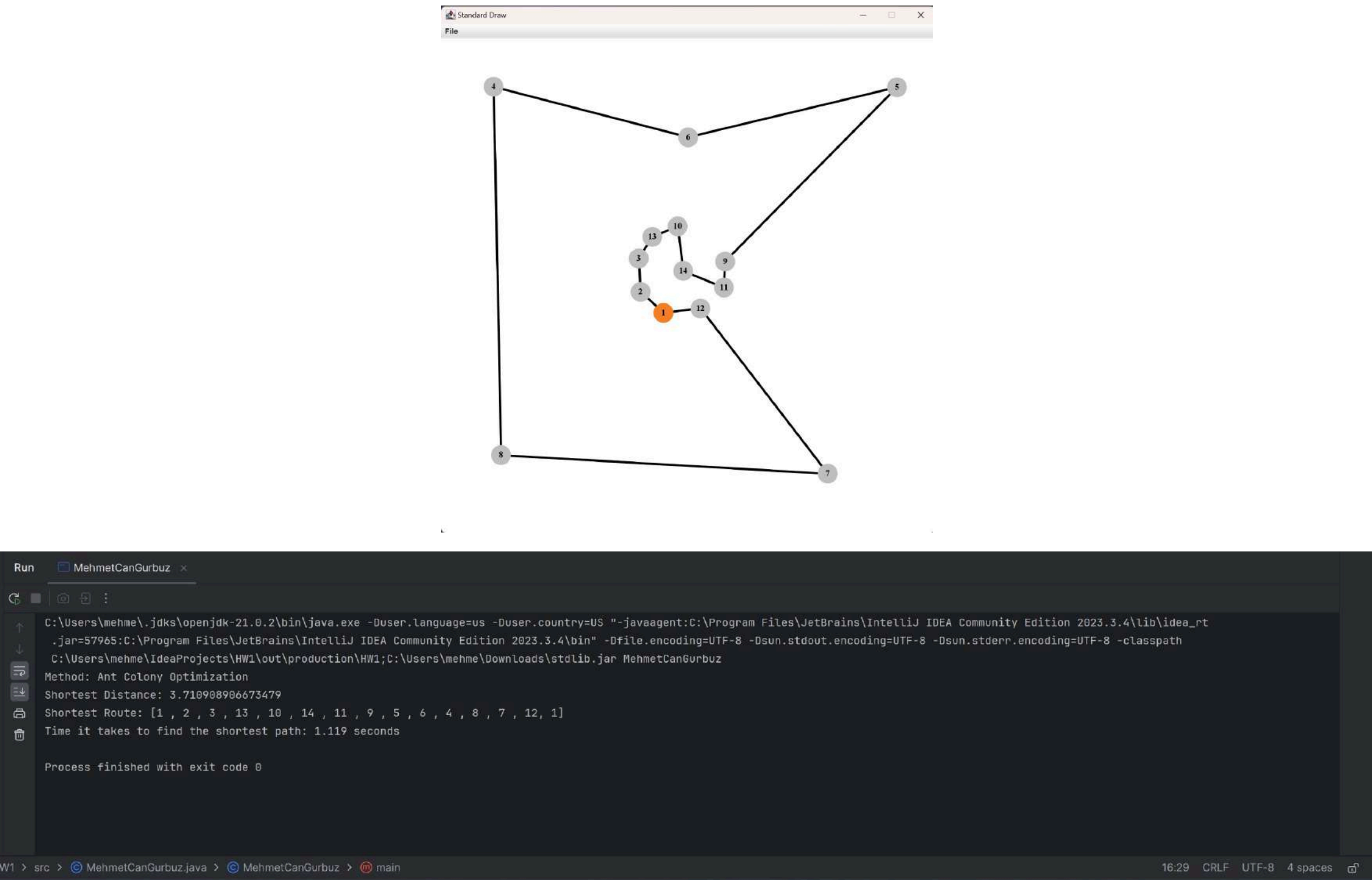
```
Run MehmetCanGurbuz x
C:\Users\mehme\.jdk\openjdk-21.0.2\bin\java.exe -Duser.language=us -Duser.country=US "-javaagent:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.4\lib\idea_rt
.jar=57894:C:\Program Files\JetBrains\IntelliJ IDEA Community Edition 2023.3.4\bin" -Dfile.encoding=UTF-8 -Dsun.stdout.encoding=UTF-8 -Dsun.stderr.encoding=UTF-8 -classpath
C:\Users\mehme\IdeaProjects\HW1\out\production\HW1;C:\Users\mehme\Downloads\stdlib.jar MehmetCanGurbuz
Method: Brute-Force Method
Shortest Distance: 3.710908906673479
Shortest Route: [1, 2, 3, 13, 10, 14, 11, 9, 5, 6, 4, 8, 7, 12, 1]
Time it takes to find the shortest path: 524.099 seconds
Process finished with exit code 0
```

- *Ant Colony Optimization Method:*
- **Constants:**

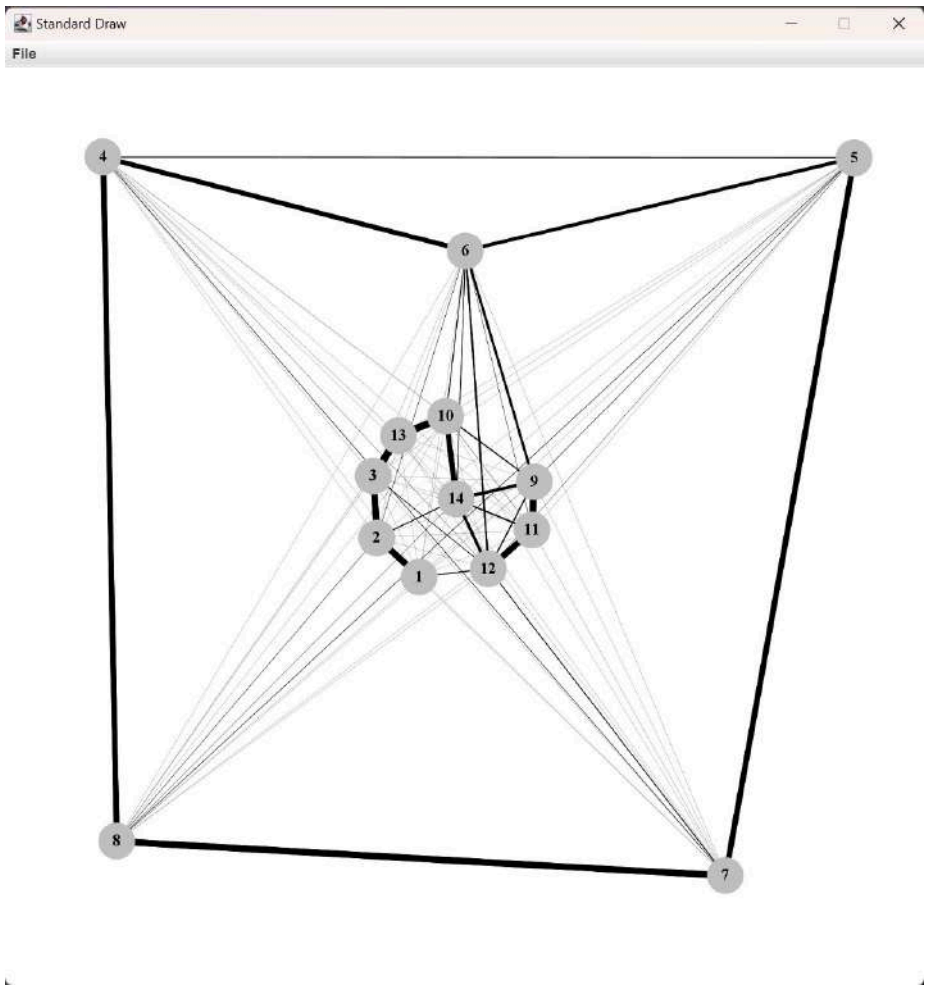
**MAX\_ITERATIONS = 500**      **NUM\_ANTS = 50**

**ALPHA = 0.7**      **BETA = 2.5**

**DEG = 0.6**      **Q = 0.0001**



**Pheromone Densities of inputfile04 :**



**Input File 5:**

- *Brute Force Method:*  
*Too long to compute.*



- *Ant Colony Optimization Method:*
- **Constants:**

*MAX\_ITERATIONS* = 500

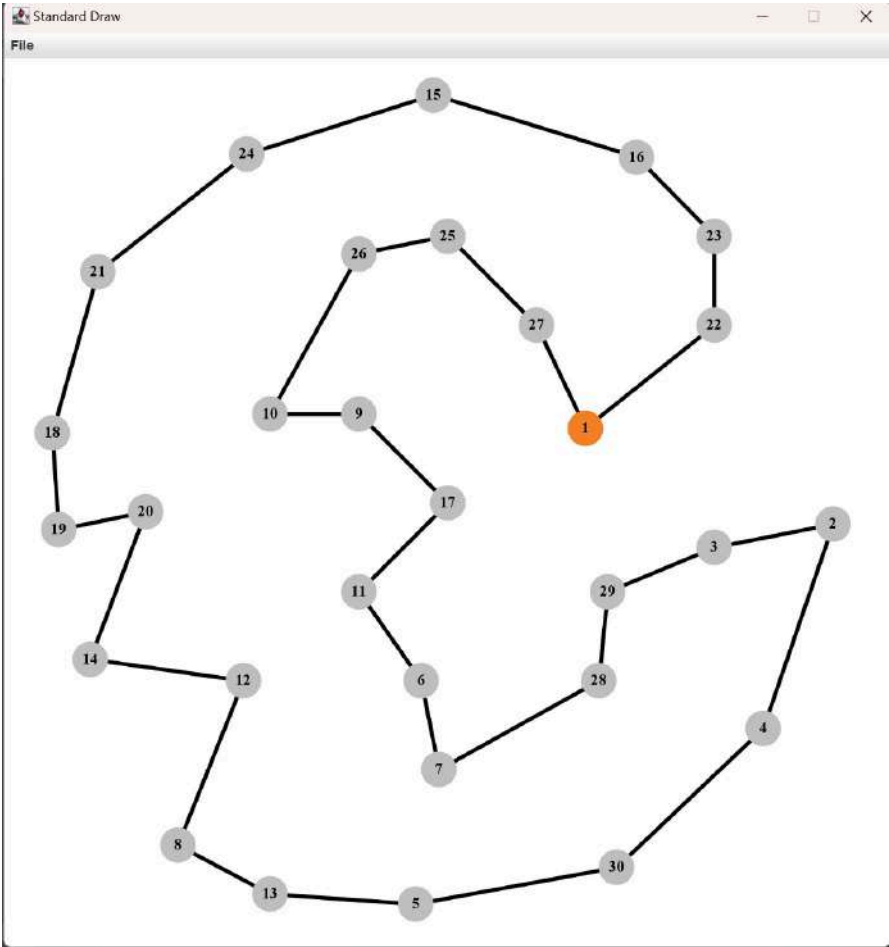
*NUM\_ANTS* = 50

*ALPHA* = 0.7

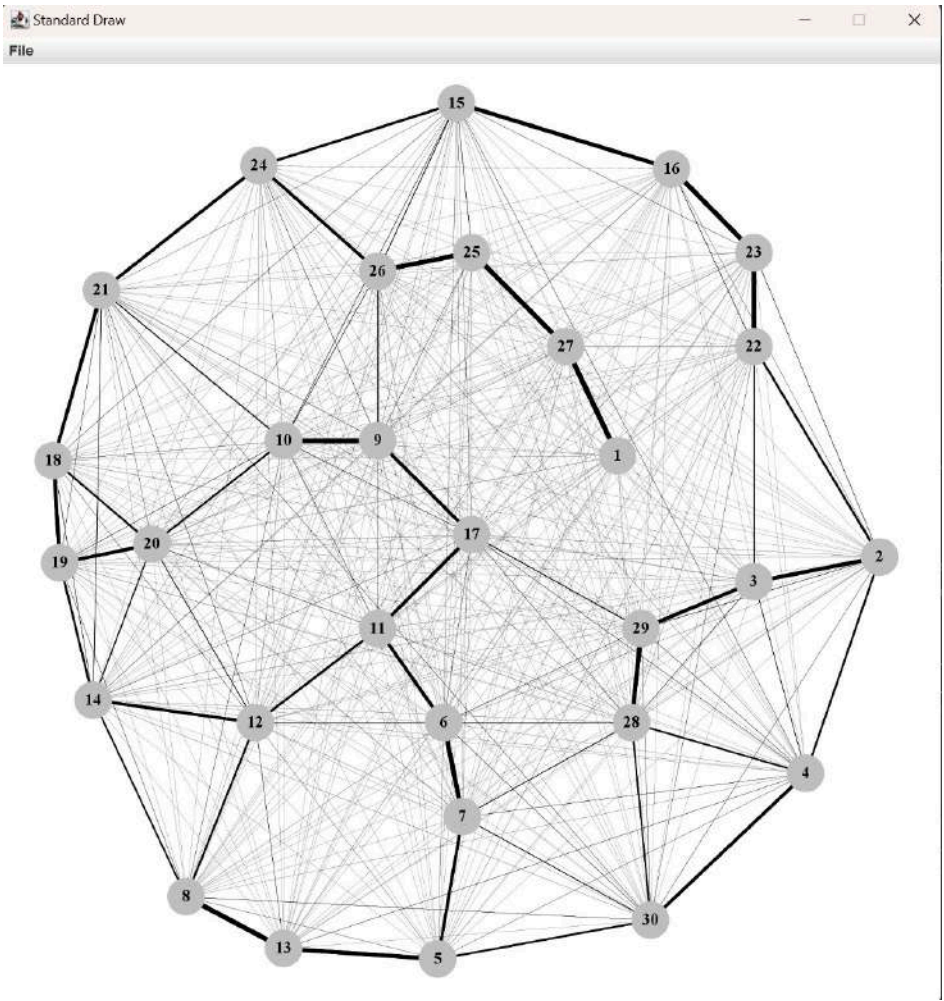
*BETA* = 2.5

*DEG* = 0.6

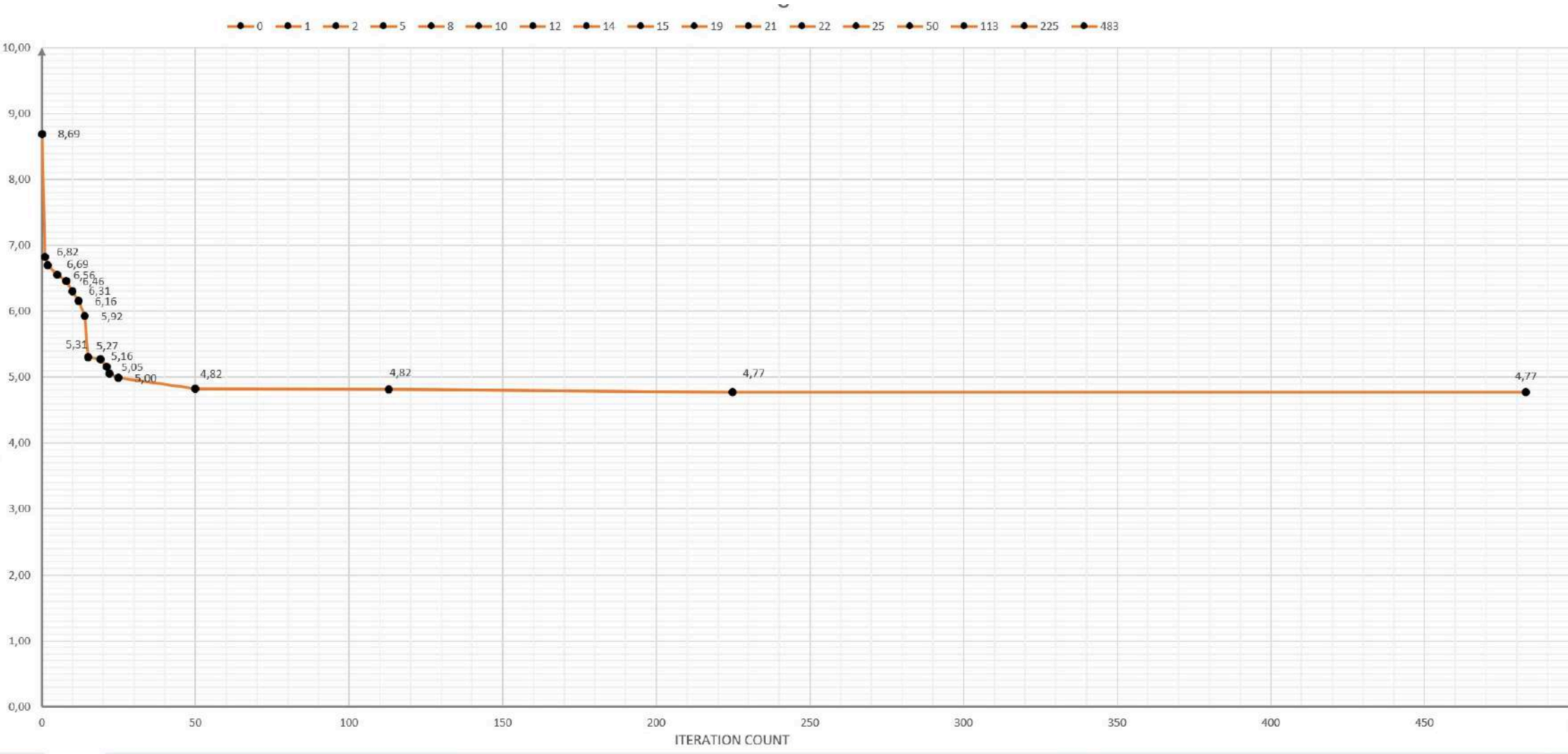
*Q* = 0.0001



**Pheromone Densities of inputfile05 :**



Best Distances VS Iteration Graph For inputfile05:



Method Comparison Table:

Input File	Number of Houses + Migros	Brute-Force Time (seconds)	Ant Colony Time (seconds)	Speed Up Factor
Input01	11	1.092 (Distance = 1.7952913856772432 )	0.948 (Distance = 1.7952913856772432 )	1.151 times faster
Input02	12	3.624 (Distance = 2.935877143237598)	1.022 (Distance = 2.935877143237598)	3.545 times faster
Input03	13	37.618 (Distance = 3.802919361826042)	1.107 (Distance = 3.802919361826042)	33.981 times faster
Input04	14	524.099 (Distance = 3.710908906673479 )	1.119 (Distance = 3.710908906673479)	468.363 times faster
Input05	30	Too long to compute	2.303 (Distance = 4.771005206672136)	Too much faster

Ant Colony Optimization Method:

Advantages:

- Provides faster and more effective results than brute force method.

- It can adapt to changing environments or problem instances by adjusting parameters such as pheromone degradation rate .

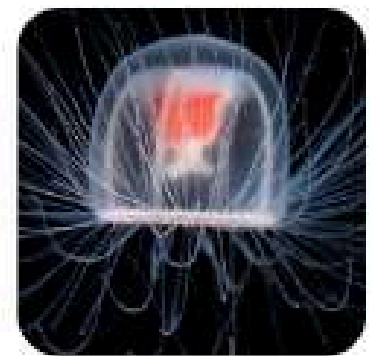
### ***Disadvantages:***

- If the number of iterations is not enough, we will get a result that is close to the real result but not accurate.
- Its performance can be sensitive to parameter settings such as the pheromone degradation rate, Alpha , Beta. Arranging these parameters for optimal performance can be challenging.

### ***Sources that I used for learning algorithms and complete the project:***

- [\*geeksforgeek.org\*](https://www.geeksforgeek.org/)
- [\*chat.openai.com\*](https://chat.openai.com/)
- [\*boun cmpe lab github link\*](#)

# ecada/ cmpe160spr24



CMPE160 Spring 2023 Introduction to Object  
Oriented Programming



1

Contributor



0

Issues



4

Stars



0

Forks

