**Tsp11 Results**

*GA Results*

Best Overall Path:

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

Distance Statistics:

DescribeResult(nobs=15, minmax=(351.04587994184993, 363.5180150830092), mean=353.4082682179201, variance=11.409248682590531, skewness=1.8162205709415395, kurtosis=3.3043467017948034)

Time Statistics:

DescribeResult(nobs=15, minmax=(2.2642061710357666, 3.6286370754241943), mean=2.6488285382588703, variance=0.10660316251282298, skewness=1.7256475817693022, kurtosis=3.545454832081975)

Beta1 GA Cost: 1.9090909090909092

Beta3 GA Cost: 3.10139477011974

*WoC Beta1*

Best Tour: [10, 3, 7, 1, 6, 4, 5, 9, 2, 11, 8, 10]

Best Tour Length: 1.9090909090909087

Insertion Order: [10, 3, 7, 1, 6, 4, 5, 9, 2, 11, 8]

Woc Execution Time for Beta1 0.004519939422607422

*WoC Beta3*

Best Tour: [8, 11, 2, 9, 5, 4, 6, 1, 7, 3, 10, 8]

Best Tour Length: 3.10139477011974

Insertion Order: [8, 11, 2, 9, 5, 4, 6, 1, 7, 3, 10]

Woc Execution Time for Beta1 0.005003929138183594

**Tsp22 Results**

*GA Results*

Best Overall Path:

[18, 22, 20, 2, 14, 9, 4, 19, 13, 10, 6, 12, 8, 17, 21, 11, 16, 3, 15, 7, 1, 5]

Distance Statistics:

DescribeResult(nobs=15, minmax=(416.0946418662267, 579.5674777311534), mean=476.5642357598892, variance=2725.5203560784926, skewness=0.5920867455682582, kurtosis=-0.9186679886198497)

Time Statistics:

DescribeResult(nobs=15, minmax=(4.64051365852356, 5.869875431060791), mean=5.01217516263326, variance=0.09644420509956607, skewness=1.448132872046341, kurtosis=1.90302939277864)

Beta1 GA Cost: 14.09090909090909

Beta3 GA Cost: 12.514361600498878

*WoC Beta1*

Best Tour: [15, 1, 5, 7, 3, 16, 11, 21, 8, 12, 6, 10, 19, 4, 9, 14, 2, 18, 22, 20, 13, 17, 15]

Best Tour Length: 16.090909090909093

Insertion Order: [15, 3, 16, 11, 7, 1, 5, 17, 21, 8, 10, 13, 19, 4, 9, 14, 2, 20, 22, 6, 12, 18]

Woc Execution Time for Beta1 0.015993118286132812

*WoC Beta3*

Best Tour: [15, 1, 5, 7, 3, 16, 11, 21, 8, 12, 6, 10, 19, 4, 9, 14, 2, 18, 22, 20, 13, 17, 15]

Best Tour Length: 14.278252157293243

Insertion Order: [15, 3, 16, 11, 7, 1, 5, 17, 21, 8, 10, 13, 19, 4, 9, 14, 2, 20, 22, 6, 12, 18]

Woc Execution Time for Beta1 0.015996456146240234

**Tsp44 Results**

*GA Results*

Best Overall Path:

[42, 3, 33, 4, 5, 39, 40, 38, 10, 35, 18, 26, 31, 29, 25, 11, 34, 24, 9, 43, 15, 16, 13, 30, 20, 8, 6, 1, 22, 28, 12, 19, 32, 17, 44, 2, 27, 7, 23, 21, 36, 14, 37, 41]

Distance Statistics:

DescribeResult(nobs=15, minmax=(706.9351549573025, 900.865554219625), mean=801.1421018611958, variance=4310.283068193667, skewness=0.007093148901147666, kurtosis=-1.3467553621333879)

Time Statistics:

DescribeResult(nobs=15, minmax=(11.30761432647705, 17.45473599433899), mean=12.87624667485555, variance=3.2527142193744067, skewness=1.3400707589297989, kurtosis=0.8296206704343874)

Beta1 GA Cost: 39.090909090909086

Beta3 GA Cost: 33.14421903694676

*WoC Beta1*

Best Tour: [21, 10, 3, 33, 8, 20, 30, 1, 22, 12, 19, 28, 13, 6, 4, 5, 42, 41, 38, 40, 39, 35, 27, 18, 23, 31, 29, 44, 32, 43, 15, 16, 17, 9, 11, 24, 34, 25, 2, 26, 7, 36, 14, 37, 21]

Best Tour Length: 39.772727272727266

Insertion Order: [21, 36, 14, 37, 7, 27, 18, 23, 31, 26, 2, 29, 25, 9, 11, 24, 34, 44, 17, 32, 43, 15, 16, 35, 10, 40, 38, 39, 3, 42, 41, 5, 33, 4, 6, 8, 20, 30, 13, 1, 22, 28, 12, 19]

Woc Execution Time for Beta1 0.2930583953857422

*WoC Beta3*

Best Tour: [34, 12, 28, 30, 20, 41, 38, 39, 35, 10, 40, 37, 36, 21, 14, 5, 3, 42, 6, 4, 33, 8, 13, 22, 1, 19, 32, 43, 15, 16, 2, 29, 31, 23, 27, 18, 7, 26, 44, 17, 24, 11, 25, 9, 34]

Best Tour Length: 34.209074181897165

Insertion Order: [34, 24, 11, 9, 25, 32, 17, 44, 43, 15, 16, 2, 26, 31, 23, 29, 7, 27, 18, 12, 19, 28, 22, 1, 30, 13, 20, 8, 6, 33, 4, 41, 42, 3, 5, 37, 14, 36, 21, 38, 40, 39, 10, 35]

Woc Execution Time for Beta1 0.22804808616638184

**Tsp77 Results**

*GA Results*

Best Overall Path:

[16, 71, 46, 22, 66, 34, 13, 6, 17, 59, 32, 12, 77, 29, 18, 15, 42, 45, 60, 31, 53, 24, 50, 64, 11, 37, 58, 43, 40, 19, 23, 52, 73, 55, 74, 62, 68, 14, 63, 33, 9, 38, 35, 65, 3, 5, 76, 10, 57, 51, 1, 39, 27, 7, 30, 20, 41, 49, 21, 26, 4, 36, 72, 2, 61, 75, 54, 69, 8, 70, 44, 25, 48, 47, 28, 56, 67]

Distance Statistics:

DescribeResult(nobs=15, minmax=(1111.4504697757766, 1475.5006810890352), mean=1291.451928946902, variance=10595.254072255162, skewness=0.18092017599085672, kurtosis=-0.81356172999226)

Time Statistics:

DescribeResult(nobs=15, minmax=(24.853601694107056, 42.33800387382507), mean=28.76682103474935, variance=21.391317817265925, skewness=1.7215873206224508, kurtosis=2.914639349242167)

Beta1 GA Cost: 73.10389610389616

Beta3 GA Cost: 63.408685911035775

*WoC Beta1*

Best Tour: [27, 53, 31, 20, 45, 41, 49, 36, 13, 34, 16, 71, 46, 67, 28, 44, 70, 25, 47, 9, 48, 14, 55, 11, 68, 52, 23, 19, 74, 62, 40, 43, 37, 51, 10, 76, 58, 1, 73, 63, 33, 56, 22, 38, 35, 64, 50, 24, 57, 66, 59, 72, 2, 29, 75, 54, 77, 12, 32, 6, 17, 8, 69, 15, 18, 61, 26, 4, 42, 21, 60, 7, 30, 39, 3, 65, 5, 27]

Best Tour Length: 73.24675324675327

Insertion Order: [27, 7, 30, 53, 20, 31, 45, 60, 21, 42, 41, 49, 36, 4, 26, 2, 61, 72, 59, 13, 66, 34, 22, 16, 67, 56, 28, 71, 46, 33, 47, 14, 48, 9, 63, 73, 55, 62, 40, 43, 1, 68, 52, 74, 23, 19, 58, 37, 51, 10, 76, 38, 35, 57, 64, 24, 50, 29, 18, 75, 54, 69, 15, 77, 12, 32, 17, 6, 8, 39, 5, 3, 65, 44, 25, 70, 11]

Woc Execution Time for Beta1 1.7433383464813232

*WoC Beta3*

Best Tour: [11, 1, 10, 76, 51, 37, 58, 43, 40, 73, 63, 9, 56, 67, 16, 71, 46, 34, 13, 59, 2, 29, 75, 54, 77, 44, 70, 25, 12, 32, 6, 17, 8, 69, 15, 18, 61, 26, 4, 42, 36, 49, 41, 60, 30, 39, 3, 65, 5, 31, 53, 20, 27, 7, 45, 21, 72, 66, 35, 64, 57, 24, 50, 38, 22, 28, 47, 48, 14, 33, 55, 68, 52, 23, 74, 62, 19, 11]

Best Tour Length: 64.0581682427567

Insertion Order: [11, 1, 43, 40, 10, 51, 76, 37, 58, 19, 62, 73, 55, 63, 33, 14, 47, 48, 9, 56, 28, 67, 16, 22, 71, 46, 34, 66, 13, 59, 72, 2, 26, 4, 61, 29, 18, 75, 54, 69, 15, 77, 12, 32, 17, 6, 8, 21, 42, 41, 49, 36, 60, 45, 7, 30, 27, 20, 31, 53, 39, 5, 3, 65, 38, 35, 57, 64, 24, 50, 68, 52, 74, 23, 25, 44, 70]

Woc Execution Time for Beta1 1.7000315189361572

**Tsp97 Results**

*GA Results*

Best Overall Path:

[39, 7, 31, 28, 45, 72, 74, 83, 70, 6, 24, 42, 10, 85, 82, 60, 79, 4, 46, 21, 94, 19, 34, 75, 2, 22, 78, 14, 76, 27, 65, 47, 12, 89, 20, 97, 49, 59, 8, 68, 11, 71, 40, 50, 56, 38, 93, 53, 96, 62, 81, 48, 36, 15, 61, 25, 23, 58, 66, 43, 87, 92, 86, 16, 90, 32, 64, 52, 80, 51, 67, 5, 1, 63, 44, 41, 88, 84, 17, 95, 9, 73, 77, 30, 13, 69, 37, 26, 3, 54, 33, 18, 57, 91, 29, 35, 55]

Distance Statistics:

DescribeResult(nobs=15, minmax=(1424.6113702022874, 2099.4402673307836), mean=1625.1341475013214, variance=35785.43692225566, skewness=1.4139932310962968, kurtosis=1.1319443602614196)

Time Statistics:

DescribeResult(nobs=15, minmax=(37.36497688293457, 48.11250567436218), mean=41.928525082270305, variance=10.599370514780535, skewness=0.4906399972004015, kurtosis=-0.5237034034957508)

Beta1 GA Cost: 93.48453608247411

Beta3 GA Cost: 82.29988983185683

*WoC Beta1*

Best Tour: [66, 92, 87, 86, 16, 1, 63, 44, 41, 84, 88, 26, 13, 69, 37, 3, 77, 30, 9, 18, 39, 57, 45, 72, 10, 6, 78, 22, 14, 74, 70, 83, 46, 4, 96, 81, 62, 48, 94, 53, 85, 19, 34, 21, 24, 42, 75, 2, 28, 76, 27, 47, 65, 31, 54, 55, 35, 33, 7, 91, 29, 73, 17, 95, 12, 89, 32, 90, 58, 8, 15, 68, 43, 67, 5, 36, 59, 71, 49, 51, 97, 80, 61, 25, 52, 64, 23, 20, 56, 50, 40, 93, 82, 60, 79, 38, 11, 66]

Best Tour Length: 82.64973655587106

Insertion Order: [66, 56, 8, 58, 59, 68, 43, 36, 67, 5, 49, 51, 20, 71, 97, 23, 80, 52, 61, 25, 64, 11, 38, 50, 40, 93, 82, 79, 60, 92, 86, 87, 16, 90, 1, 63, 95, 44, 17, 30, 41, 37, 69, 84, 88, 26, 13, 3, 77, 9, 73, 18, 29, 91, 57, 7, 31, 33, 54, 35, 55, 32, 12, 89, 39, 45, 28, 65, 76, 27, 47, 2, 72, 10, 75, 6, 83, 70, 78, 22, 74, 14, 24, 42, 46, 21, 4, 34, 19, 96, 85, 53, 94, 62, 81, 48, 15]

Woc Execution Time for Beta1 4.891494274139404

*WoC Beta3*

Best Tour: [15, 36, 5, 90, 16, 92, 87, 86, 1, 63, 44, 41, 84, 88, 26, 13, 69, 37, 3, 77, 30, 9, 18, 39, 57, 45, 72, 10, 6, 78, 22, 14, 74, 70, 83, 46, 4, 96, 81, 62, 48, 94, 53, 85, 19, 34, 21, 24, 42, 75, 2, 28, 76, 27, 47, 65, 31, 54, 55, 35, 33, 7, 91, 29, 73, 17, 95, 12, 89, 32, 67, 43, 68, 8, 66, 58, 56, 50, 40, 93, 82, 60, 79, 38, 11, 59, 71, 49, 51, 97, 80, 61, 25, 52, 64, 23, 20, 15]

Best Tour Length: 93.40206185567003

Insertion Order: [15, 8, 59, 66, 56, 68, 43, 36, 67, 5, 58, 11, 38, 50, 40, 93, 82, 79, 60, 49, 51, 20, 71, 97, 23, 80, 52, 61, 25, 64, 1, 90, 63, 95, 16, 44, 17, 30, 41, 37, 69, 84, 88, 26, 13, 3, 77, 9, 73, 18, 29, 91, 57, 7, 31, 33, 54, 35, 55, 32, 12, 89, 86, 92, 87, 39, 45, 28, 65, 76, 27, 47, 2, 72, 10, 75, 6, 83, 70, 78, 22, 74, 14, 24, 42, 46, 21, 4, 34, 19, 96, 85, 53, 94, 62, 81, 48]

Woc Execution Time for Beta1 5.083719730377197

**Tsp222 Results**

*GA Results*

Best Overall Path:

[54, 100, 116, 11, 120, 111, 165, 133, 199, 149, 173, 163, 49, 187, 209, 205, 55, 63, 60, 78, 46, 17, 123, 20, 143, 82, 124, 51, 6, 219, 22, 32, 119, 101, 127, 21, 195, 30, 8, 79, 67, 188, 125, 14, 196, 24, 59, 98, 64, 7, 150, 4, 58, 42, 160, 110, 146, 62, 28, 88, 148, 178, 107, 5, 138, 156, 132, 97, 1, 103, 9, 81, 23, 217, 139, 45, 167, 47, 207, 214, 134, 39, 166, 35, 198, 95, 19, 41, 50, 118, 159, 69, 92, 71, 158, 208, 161, 197, 117, 189, 144, 26, 16, 61, 128, 29, 154, 112, 164, 109, 37, 131, 84, 182, 2, 40, 206, 137, 194, 115, 157, 53, 31, 179, 73, 36, 96, 202, 170, 221, 176, 171, 142, 201, 145, 129, 86, 212, 83, 177, 75, 181, 105, 168, 222, 180, 25, 44, 68, 77, 91, 74, 3, 218, 152, 72, 52, 186, 90, 210, 213, 191, 140, 33, 204, 27, 99, 66, 13, 43, 183, 34, 76, 141, 162, 10, 89, 56, 38, 211, 104, 57, 203, 147, 121, 215, 174, 153, 85, 155, 135, 151, 220, 87, 93, 18, 172, 169, 15, 193, 126, 200, 122, 106, 175, 136, 65, 130, 80, 185, 216, 12, 114, 113, 70, 94, 102, 108, 192, 190, 184, 48]

Distance Statistics:

DescribeResult(nobs=15, minmax=(3195.499650258671, 4192.049882566444), mean=3554.2668893882374, variance=69689.14441450573, skewness=0.8390157910584407, kurtosis=0.42485377163837423)

Time Statistics:

DescribeResult(nobs=15, minmax=(117.57220411300659, 132.46949362754822), mean=122.52974762916566, variance=15.306505083878537, skewness=1.0317735943771622, kurtosis=0.8148975273398484)

Beta1 GA Cost: 219.40090090090112

Beta3 GA Cost: 200.7520436843241

*WoC Beta1*

Best Tour: [17, 196, 221, 55, 205, 133, 120, 110, 160, 185, 165, 96, 105, 42, 176, 59, 64, 47, 167, 150, 7, 122, 106, 170, 46, 145, 4, 21, 182, 35, 198, 37, 48, 184, 31, 56, 210, 137, 206, 26, 208, 186, 115, 204, 27, 191, 135, 151, 220, 102, 108, 93, 203, 1, 70, 178, 180, 100, 54, 114, 138, 126, 157, 18, 15, 211, 104, 200, 155, 38, 169, 172, 113, 107, 116, 44, 12, 147, 193, 85, 121, 87, 68, 174, 215, 10, 194, 90, 34, 141, 43, 72, 152, 218, 89, 2, 40, 154, 183, 140, 161, 197, 117, 189, 76, 19, 164, 3, 112, 71, 33, 213, 52, 162, 99, 91, 13, 66, 74, 77, 53, 190, 144, 95, 166, 101, 39, 134, 143, 92, 119, 79, 188, 128, 159, 124, 82, 58, 60, 177, 75, 201, 209, 217, 163, 212, 149, 83, 207, 214, 63, 181, 129, 41, 84, 131, 16, 51, 158, 29, 6, 50, 118, 61, 32, 22, 219, 195, 69, 125, 8, 202, 175, 73, 179, 168, 65, 98, 136, 57, 192, 36, 173, 216, 132, 156, 5, 25, 88, 148, 153, 28, 97, 11, 222, 62, 146, 9, 111, 94, 103, 81, 23, 80, 130, 199, 45, 139, 86, 49, 127, 30, 109, 14, 67, 24, 171, 78, 187, 123, 20, 142, 17]

Best Tour Length: 219.2702702702702

Insertion Order: [17, 142, 123, 187, 78, 20, 196, 24, 171, 67, 14, 109, 127, 30, 221, 55, 86, 49, 205, 139, 45, 199, 133, 130, 80, 111, 23, 81, 94, 103, 120, 9, 110, 62, 146, 160, 11, 222, 216, 97, 132, 156, 5, 25, 28, 88, 148, 153, 185, 173, 96, 36, 136, 57, 192, 98, 165, 168, 65, 202, 73, 175, 179, 105, 42, 145, 176, 46, 59, 7, 47, 167, 150, 64, 122, 106, 170, 4, 125, 8, 21, 195, 69, 182, 61, 219, 32, 22, 16, 6, 118, 50, 29, 51, 84, 131, 35, 101, 119, 198, 166, 95, 37, 48, 184, 144, 190, 31, 53, 77, 56, 74, 91, 66, 13, 162, 99, 210, 52, 213, 33, 137, 206, 26, 112, 3, 208, 161, 197, 117, 189, 76, 186, 115, 194, 90, 140, 204, 10, 27, 191, 215, 151, 135, 220, 87, 121, 102, 68, 174, 85, 108, 193, 93, 147, 203, 1, 70, 180, 100, 12, 116, 107, 178, 54, 113, 114, 138, 126, 157, 18, 155, 169, 211, 104, 200, 15, 38, 172, 44, 34, 183, 43, 141, 72, 152, 218, 2, 40, 89, 154, 164, 19, 71, 39, 92, 134, 143, 79, 41, 124, 82, 188, 159, 128, 58, 129, 207, 60, 83, 177, 209, 75, 201, 217, 163, 149, 212, 181, 214, 63, 158]

Woc Execution Time for Beta1 95.02817511558533

*WoC Beta3*

Best Tour: [202, 170, 106, 122, 98, 167, 150, 4, 21, 182, 35, 198, 37, 48, 184, 31, 56, 210, 137, 206, 26, 208, 186, 115, 204, 27, 191, 135, 151, 220, 102, 108, 93, 203, 1, 111, 165, 222, 138, 126, 157, 18, 15, 211, 104, 168, 65, 200, 169, 113, 54, 100, 180, 178, 62, 146, 107, 116, 44, 12, 172, 38, 155, 114, 5, 156, 97, 216, 185, 80, 212, 83, 60, 142, 201, 75, 78, 63, 181, 221, 196, 127, 30, 109, 143, 134, 39, 92, 14, 67, 55, 205, 217, 139, 171, 24, 214, 187, 17, 123, 20, 46, 58, 82, 41, 124, 159, 128, 188, 207, 129, 209, 177, 149, 163, 86, 49, 45, 199, 173, 160, 132, 28, 148, 153, 88, 25, 11, 120, 9, 81, 23, 130, 110, 133, 103, 94, 70, 147, 193, 85, 121, 87, 68, 174, 215, 10, 194, 90, 34, 141, 43, 72, 152, 218, 89, 2, 40, 154, 183, 140, 161, 197, 117, 189, 76, 19, 164, 3, 112, 71, 33, 213, 52, 162, 99, 91, 13, 66, 74, 77, 53, 190, 144, 95, 166, 101, 79, 119, 84, 131, 16, 51, 158, 29, 6, 50, 118, 61, 32, 22, 219, 195, 69, 125, 8, 145, 176, 42, 64, 47, 7, 59, 105, 96, 36, 136, 57, 192, 175, 73, 179, 202]

Best Tour Length: 202.63085239779505

Insertion Order: [202, 73, 175, 179, 96, 36, 136, 57, 192, 105, 170, 106, 122, 7, 59, 98, 167, 47, 150, 64, 145, 42, 176, 4, 125, 8, 21, 195, 69, 182, 61, 219, 32, 22, 16, 6, 118, 50, 29, 51, 84, 131, 35, 101, 119, 198, 166, 95, 37, 48, 184, 144, 190, 31, 53, 77, 56, 74, 91, 66, 13, 162, 99, 210, 52, 213, 33, 137, 206, 26, 112, 3, 208, 161, 197, 117, 189, 76, 186, 115, 194, 90, 140, 204, 10, 27, 191, 215, 151, 135, 220, 87, 121, 102, 68, 174, 85, 108, 193, 93, 147, 203, 1, 70, 103, 94, 130, 133, 110, 111, 23, 81, 120, 9, 165, 222, 11, 5, 25, 156, 132, 97, 28, 88, 148, 153, 114, 138, 126, 157, 18, 155, 169, 211, 104, 200, 15, 65, 168, 38, 172, 113, 54, 100, 12, 116, 107, 180, 62, 146, 178, 44, 216, 160, 185, 173, 80, 45, 199, 212, 86, 49, 163, 149, 83, 177, 209, 60, 58, 129, 207, 82, 142, 17, 123, 187, 78, 20, 201, 75, 214, 63, 181, 171, 24, 55, 205, 139, 221, 196, 67, 14, 109, 127, 30, 143, 134, 39, 92, 217, 46, 124, 41, 188, 159, 128, 34, 183, 43, 141, 72, 152, 218, 2, 40, 89, 154, 164, 19, 71, 79, 158]

Woc Execution Time for Beta1 95.1072084903717









