Logs

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========== ORIGINAL CITIES ==========

[(0.35073057755759374, 0.622631460750067), (0.2818355582102282, 0.7304521388737506), (0.811342950718551, 0.09431418616748855), (0.2774409598632267, 0.7488159062123383), (0.11109925178004587, 0.2295150478434992), (0.23388808398682992, 0.11045479497333988), (0.7540370098794769, 0.6114960440731767)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.3646473361630136

optimal path: ((0.2818355582102282, 0.7304521388737506), (0.35073057755759374, 0.622631460750067), (0.7540370098794769, 0.6114960440731767), (0.811342950718551, 0.09431418616748855), (0.23388808398682992, 0.11045479497333988), (0.11109925178004587, 0.2295150478434992), (0.2774409598632267, 0.7488159062123383))

========== RANDOM SOLUTION ==========

random distance: 3.192315270600337

random path: [(0.23388808398682992, 0.11045479497333988), (0.11109925178004587, 0.2295150478434992), (0.2774409598632267, 0.7488159062123383), (0.35073057755759374, 0.622631460750067), (0.811342950718551, 0.09431418616748855), (0.7540370098794769, 0.6114960440731767), (0.2818355582102282, 0.7304521388737506)]

========== AI SOLUTIONS ==========

ai distance: 2.3646473361630136

ai path: [(0.811342950718551, 0.09431418616748855), (0.7540370098794769, 0.6114960440731767), (0.35073057755759374, 0.622631460750067), (0.2818355582102282, 0.7304521388737506), (0.2774409598632267, 0.7488159062123383), (0.11109925178004587, 0.2295150478434992), (0.23388808398682992, 0.11045479497333988)]

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========== ORIGINAL CITIES ==========

[(0.48964075546910246, 0.7229068958552065), (0.7438382875284177, 0.13400117915106846), (0.1810279210960305, 0.8265383865543794), (0.2015487103240865, 0.7307187667797437), (0.8896455513120723, 0.11362577420942566), (0.5043772985882965, 0.48805976757604685), (0.5601632373544364, 0.19410229218086117)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.1801371048393032

optimal path: ((0.48964075546910246, 0.7229068958552065), (0.1810279210960305, 0.8265383865543794), (0.2015487103240865, 0.7307187667797437), (0.5043772985882965, 0.48805976757604685), (0.5601632373544364, 0.19410229218086117), (0.7438382875284177, 0.13400117915106846), (0.8896455513120723, 0.11362577420942566))

========== RANDOM SOLUTION ==========

random distance: 3.858115024733336

random path: [(0.5043772985882965, 0.48805976757604685), (0.48964075546910246, 0.7229068958552065), (0.5601632373544364, 0.19410229218086117), (0.1810279210960305, 0.8265383865543794), (0.7438382875284177, 0.13400117915106846), (0.8896455513120723, 0.11362577420942566), (0.2015487103240865, 0.7307187667797437)]

========== AI SOLUTIONS ==========

ai distance: 2.1819923339697356

ai path: [(0.5601632373544364, 0.19410229218086117), (0.7438382875284177, 0.13400117915106846), (0.8896455513120723, 0.11362577420942566), (0.5043772985882965, 0.48805976757604685), (0.48964075546910246, 0.7229068958552065), (0.1810279210960305, 0.8265383865543794), (0.2015487103240865, 0.7307187667797437)]

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========= ORIGINAL CITIES =========

[(0.9913279308541296, 0.713953899887595), (0.7305059888301668, 0.3074401530775607), (0.6661431568832775, 0.32633522298937123), (0.5372463038871819, 0.370295478979063), (0.35408135805702456, 0.9432802155493251), (0.025177104214625046, 0.07271152855228069), (0.03747296899266428, 0.6131372321628231)]

========= OPTIMAL SOLUTION =========

optimal distance: 2.953760144515838

optimal path: ((0.9913279308541296, 0.713953899887595), (0.35408135805702456, 0.9432802155493251), (0.03747296899266428, 0.6131372321628231), (0.025177104214625046, 0.07271152855228069), (0.5372463038871819, 0.370295478979063), (0.6661431568832775, 0.32633522298937123), (0.7305059888301668, 0.3074401530775607))

========= RANDOM SOLUTION =========

random distance: 4.35078986993084

random path: [(0.5372463038871819, 0.370295478979063), (0.35408135805702456, 0.9432802155493251), (0.7305059888301668, 0.3074401530775607), (0.9913279308541296, 0.713953899887595), (0.025177104214625046, 0.07271152855228069), (0.03747296899266428, 0.6131372321628231), (0.6661431568832775, 0.32633522298937123)]

========= AI SOLUTIONS =========

ai distance: 2.953760144515838

ai path: [(0.5372463038871819, 0.370295478979063), (0.025177104214625046, 0.07271152855228069), (0.03747296899266428, 0.6131372321628231), (0.35408135805702456, 0.9432802155493251), (0.9913279308541296, 0.713953899887595), (0.7305059888301668, 0.3074401530775607), (0.6661431568832775, 0.32633522298937123)]

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========= ORIGINAL CITIES =========

[(0.257921486890054, 0.025995921910791697), (0.4833002175200676, 0.7245777949806724), (0.07084122838924412, 0.37143314377610515), (0.8362367939483898, 0.5576968051084532), (0.045941130599571944, 0.8332578878281734), (0.08393650295932198, 0.8764539560615769), (0.5934409196627022, 0.5206820322713788)]

========= OPTIMAL SOLUTION =========

optimal distance: 2.573873607073708

optimal path: ((0.257921486890054, 0.025995921910791697), (0.07084122838924412, 0.37143314377610515), (0.045941130599571944, 0.8332578878281734), (0.08393650295932198, 0.8764539560615769), (0.4833002175200676, 0.7245777949806724), (0.8362367939483898, 0.5576968051084532), (0.5934409196627022, 0.5206820322713788))

========= RANDOM SOLUTION =========

random distance: 4.168353154125108

random path: [(0.8362367939483898, 0.5576968051084532), (0.257921486890054, 0.025995921910791697), (0.045941130599571944, 0.8332578878281734), (0.4833002175200676, 0.7245777949806724), (0.5934409196627022, 0.5206820322713788), (0.07084122838924412, 0.37143314377610515), (0.08393650295932198, 0.8764539560615769)]

========= AI SOLUTIONS =========

ai distance: 2.573873607073708

ai path: [(0.257921486890054, 0.025995921910791697), (0.07084122838924412, 0.37143314377610515), (0.045941130599571944, 0.8332578878281734), (0.08393650295932198, 0.8764539560615769), (0.4833002175200676, 0.7245777949806724), (0.8362367939483898, 0.5576968051084532), (0.5934409196627022, 0.5206820322713788)]

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========= ORIGINAL CITIES =========

[(0.39889386080068523, 0.585998175325064), (0.5162945124150476, 0.9041518172255687), (0.2374714563931859, 0.9162350167488922), (0.9269116167362651, 0.8700704785164571), (0.8653522928572974, 0.42765569110741575), (0.7106735678188508, 0.4727953504135167), (0.8604630203783885, 0.0552407322436923)]

========= OPTIMAL SOLUTION =========

optimal distance: 2.653119498178098

optimal path: ((0.8653522928572974, 0.42765569110741575), (0.8604630203783885, 0.0552407322436923), (0.7106735678188508, 0.4727953504135167), (0.39889386080068523, 0.585998175325064), (0.2374714563931859, 0.9162350167488922), (0.5162945124150476, 0.9041518172255687), (0.9269116167362651, 0.8700704785164571))

========= RANDOM SOLUTION =========

random distance: 3.565362620515191

random path: [(0.2374714563931859, 0.9162350167488922), (0.8604630203783885, 0.0552407322436923), (0.8653522928572974, 0.42765569110741575), (0.9269116167362651, 0.8700704785164571), (0.39889386080068523, 0.585998175325064), (0.7106735678188508, 0.4727953504135167), (0.5162945124150476, 0.9041518172255687)]

========= AI SOLUTIONS =========

ai distance: 2.6531194981780986

ai path: [(0.2374714563931859, 0.9162350167488922), (0.39889386080068523, 0.585998175325064), (0.7106735678188508, 0.4727953504135167), (0.8604630203783885, 0.0552407322436923), (0.8653522928572974, 0.42765569110741575), (0.9269116167362651, 0.8700704785164571), (0.5162945124150476, 0.9041518172255687)]

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========= ORIGINAL CITIES =========

[(0.4725695434410363, 0.8469266473250633), (0.32971966796759433, 0.7788054610307186), (0.9886162809258537, 0.16194480001866285), (0.19086611204978643, 0.6141873899053368), (0.9726439496804175, 0.24384021667171252), (0.4350786357128932, 0.16073412459104464), (0.5926070015529072, 0.25138034693990263)]

========= OPTIMAL SOLUTION =========

optimal distance: 2.3432677168442857

optimal path: ((0.4725695434410363, 0.8469266473250633), (0.32971966796759433, 0.7788054610307186), (0.19086611204978643, 0.6141873899053368), (0.4350786357128932, 0.16073412459104464), (0.5926070015529072, 0.25138034693990263), (0.9886162809258537, 0.16194480001866285), (0.9726439496804175, 0.24384021667171252))

========= RANDOM SOLUTION =========

random distance: 3.403077880584986

random path: [(0.5926070015529072, 0.25138034693990263), (0.4350786357128932, 0.16073412459104464), (0.4725695434410363, 0.8469266473250633), (0.9886162809258537, 0.16194480001866285), (0.9726439496804175, 0.24384021667171252), (0.32971966796759433, 0.7788054610307186), (0.19086611204978643, 0.6141873899053368)]

========= AI SOLUTIONS =========

ai distance: 2.3432677168442857

ai path: [(0.4725695434410363, 0.8469266473250633), (0.32971966796759433, 0.7788054610307186), (0.19086611204978643, 0.6141873899053368), (0.4350786357128932, 0.16073412459104464), (0.5926070015529072, 0.25138034693990263), (0.9886162809258537, 0.16194480001866285), (0.9726439496804175, 0.24384021667171252)]

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========= ORIGINAL CITIES =========

[(0.41723973363781386, 0.7573913322828194), (0.8837465563867212, 0.709270322195574), (0.9070537438061167, 0.5635729941793213), (0.7086009444613988, 0.4762449869637465), (0.5023762988852014, 0.6158822538586427), (0.8496037503366066, 0.3824702753635235), (0.755858122956517, 0.41541668699648804)]

========= OPTIMAL SOLUTION =========

optimal distance: 1.397121188859637

optimal path: ((0.9070537438061167, 0.5635729941793213), (0.8837465563867212, 0.709270322195574), (0.41723973363781386, 0.7573913322828194), (0.5023762988852014, 0.6158822538586427), (0.7086009444613988, 0.4762449869637465), (0.755858122956517, 0.41541668699648804), (0.8496037503366066, 0.3824702753635235))

========= RANDOM SOLUTION =========

random distance: 2.064681819085888

random path: [(0.8496037503366066, 0.3824702753635235), (0.755858122956517, 0.41541668699648804), (0.7086009444613988, 0.4762449869637465), (0.5023762988852014, 0.6158822538586427), (0.8837465563867212, 0.709270322195574), (0.9070537438061167, 0.5635729941793213), (0.41723973363781386, 0.7573913322828194)]

========= AI SOLUTIONS =========

ai distance: 1.397121188859637

ai path: [(0.5023762988852014, 0.6158822538586427), (0.7086009444613988, 0.4762449869637465), (0.755858122956517, 0.41541668699648804), (0.8496037503366066, 0.3824702753635235), (0.9070537438061167, 0.5635729941793213), (0.8837465563867212, 0.709270322195574), (0.41723973363781386, 0.7573913322828194)]

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========= ORIGINAL CITIES =========

[(0.8145000157556712, 0.64010933389593074), (0.1433808866137838, 0.16573357429036606), (0.9491451609708556, 0.2307723516290976), (0.39184353771599423, 0.6201781805000318), (0.6368490240103212, 0.7795779344456093), (0.6448476636298901, 0.9556367737239), (0.048000488657714224, 0.6630449455498286)]

========= OPTIMAL SOLUTION =========

optimal distance: 2.9144464307924056

optimal path: ((0.8145000157556712, 0.64010933389593074), (0.9491451609708556, 0.2307723516290976), (0.1433808866137838, 0.16573357429036606), (0.048000488657714224, 0.6630449455498286), (0.39184353771599423, 0.6201781805000318), (0.6448476636298901, 0.9556367737239), (0.6368490240103212, 0.7795779344456093))

========= RANDOM SOLUTION =========

random distance: 3.7207526108271916

random path: [(0.39184353771599423, 0.6201781805000318), (0.1433808866137838, 0.16573357429036606), (0.9491451609708556, 0.2307723516290976), (0.8145000157556712, 0.64010933389593074), (0.048000488657714224, 0.6630449455498286), (0.6368490240103212, 0.7795779344456093), (0.6448476636298901, 0.9556367737239)]

========= AI SOLUTIONS =========

ai distance: 2.9144464307924056

ai path: [(0.8145000157556712, 0.6401093389593074), (0.9491451609708556, 0.2307723516290976), (0.1433808866137838, 0.16573357429036606), (0.048000488657714224, 0.6630449455498286), (0.39184353771599423, 0.6201781805000318), (0.6448476636298901, 0.9556367737239), (0.6368490240103212, 0.7795779344456093)]

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========== ORIGINAL CITIES ==========

[(0.2146062824925119, 0.7572307099005265), (0.6081873225930509, 0.3876625525997567), (0.7917454245713761, 0.7901368148692159), (0.2537516099972158, 0.014747098654172341), (0.4841204705849229, 0.5470724303602581), (0.6202414634748411, 0.35839937644775455), (0.6240743258383875, 0.00100547955698016)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.675295182273933

optimal path: ((0.2146062824925119, 0.7572307099005265), (0.7917454245713761, 0.7901368148692159), (0.4841204705849229, 0.5470724303602581), (0.6081873225930509, 0.3876625525997567), (0.6202414634748411, 0.35839937644775455), (0.6240743258383875, 0.00100547955698016), (0.2537516099972158, 0.014747098654172341))

========== RANDOM SOLUTION ==========

random distance: 3.462219691893292

random path: [(0.6240743258383875, 0.00100547955698016), (0.2146062824925119, 0.7572307099005265), (0.4841204705849229, 0.5470724303602581), (0.7917454245713761, 0.7901368148692159), (0.6202414634748411, 0.35839937644775455), (0.2537516099972158, 0.014747098654172341), (0.6081873225930509, 0.3876625525997567)]

========== AI SOLUTIONS ==========

ai distance: 2.675295182273933

ai path: [(0.6081873225930509, 0.3876625525997567), (0.4841204705849229, 0.5470724303602581), (0.7917454245713761, 0.7901368148692159), (0.2146062824925119, 0.7572307099005265), (0.2537516099972158, 0.014747098654172341), (0.6240743258383875, 0.00100547955698016), (0.6202414634748411, 0.35839937644775455)]

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========== ORIGINAL CITIES ==========

[(0.24101628905664796, 0.29099659704970915), (0.7151281623456115, 0.8399174176304796), (0.46425983072515686, 0.7143511783684611), (0.9913166584542723, 0.08728612807062952), (0.9207653749116637, 0.6896219293487496), (0.8331662345420902, 0.4005470689386007), (0.6322498444579858, 0.7347629483834867)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.4668680785162898

optimal path: ((0.9207653749116637, 0.6896219293487496), (0.7151281623456115, 0.8399174176304796), (0.6322498444579858, 0.7347629483834867), (0.46425983072515686, 0.7143511783684611), (0.24101628905664796, 0.29099659704970915), (0.9913166584542723, 0.08728612807062952), (0.8331662345420902, 0.4005470689386007))

========== RANDOM SOLUTION ==========

random distance: 3.9257553912038636

random path: [(0.24101628905664796, 0.29099659704970915), (0.46425983072515686, 0.7143511783684611), (0.9913166584542723, 0.08728612807062952), (0.6322498444579858, 0.7347629483834867), (0.8331662345420902, 0.4005470689386007), (0.7151281623456115, 0.8399174176304796), (0.9207653749116637, 0.6896219293487496)]

========== AI SOLUTIONS ==========

ai distance: 2.4668680785162898

ai path: [(0.8331662345420902, 0.4005470689386007), (0.9913166584542723, 0.08728612807062952), (0.24101628905664796, 0.29099659704970915), (0.46425983072515686, 0.7143511783684611), (0.6322498444579858, 0.7347629483834867), (0.7151281623456115, 0.8399174176304796), (0.9207653749116637, 0.6896219293487496)]

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========== ORIGINAL CITIES ==========

[(0.7296267640907431, 0.839722888941653), (0.4840169381897339, 0.6195327433164971), (0.09413203866457731, 0.7042642118329), (0.6873568865989013, 0.5399860666633006), (0.18363893891147143, 0.6441199974167154), (0.6168449226329709, 0.5673902780250433), (0.9638041990796941, 0.5644638925041597)]

========== OPTIMAL SOLUTION ==========

optimal distance: 1.9162608806059593

optimal path: ((0.7296267640907431, 0.839722888941653), (0.09413203866457731, 0.7042642118329), (0.18363893891147143, 0.6441199974167154), (0.4840169381897339, 0.6195327433164971), (0.6168449226329709, 0.5673902780250433), (0.6873568865989013, 0.5399860666633006), (0.9638041990796941, 0.5644638925041597))

========== RANDOM SOLUTION ==========

random distance: 2.174957409874433

random path: [(0.9638041990796941, 0.5644638925041597), (0.7296267640907431, 0.839722888941653), (0.6873568865989013, 0.5399860666633006), (0.18363893891147143, 0.6441199974167154), (0.09413203866457731, 0.7042642118329), (0.4840169381897339, 0.6195327433164971), (0.6168449226329709, 0.5673902780250433)]

========== AI SOLUTIONS ==========

ai distance: 1.9162608806059593

ai path: [(0.7296267640907431, 0.839722888941653), (0.9638041990796941, 0.5644638925041597), (0.6873568865989013, 0.5399860666633006), (0.6168449226329709, 0.5673902780250433), (0.4840169381897339, 0.6195327433164971), (0.18363893891147143, 0.6441199974167154), (0.09413203866457731, 0.7042642118329)]

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========== ORIGINAL CITIES ==========

[(0.7793868451449326, 0.18188370922292063), (0.5398997608603232, 0.3672514542553943), (0.7704399619981208, 0.5999558654624338), (0.23792805941920014, 0.3715482235470271), (0.39169370795134384, 0.9149167183299647), (0.48838787501757863, 0.626979548280787), (0.9389118121196434, 0.11160448412116386)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.4475511132426755

optimal path: ((0.7793868451449326, 0.18188370922292063), (0.9389118121196434, 0.11160448412116386), (0.7704399619981208, 0.5999558654624338), (0.48838787501757863, 0.626979548280787), (0.39169370795134384, 0.9149167183299647), (0.23792805941920014, 0.3715482235470271), (0.5398997608603232, 0.3672514542553943))

========== RANDOM SOLUTION ==========

random distance: 2.839462167532673

random path: [(0.23792805941920014, 0.3715482235470271), (0.7704399619981208, 0.5999558654624338), (0.39169370795134384, 0.9149167183299647), (0.48838787501757863, 0.626979548280787), (0.9389118121196434, 0.11160448412116386), (0.7793868451449326, 0.18188370922292063), (0.5398997608603232, 0.3672514542553943)]

========== AI SOLUTIONS ==========

ai distance: 2.4475511132426755

ai path: [(0.23792805941920014, 0.3715482235470271), (0.39169370795134384, 0.9149167183299647), (0.48838787501757863, 0.626979548280787), (0.7704399619981208, 0.5999558654624338), (0.9389118121196434, 0.11160448412116386), (0.7793868451449326, 0.18188370922292063), (0.5398997608603232, 0.3672514542553943)]

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========== ORIGINAL CITIES ==========

[(0.5430144971934259, 0.2829868625153098), (0.720144445659883, 0.8203534989820102), (0.5060057739734626, 0.5842337164828938), (0.6356066888924083, 0.5058254013788115), (0.9788058739082659, 0.25707281234179735), (0.6872283916500034, 0.30159273630635774), (0.05094985066614366, 0.1938757519500467)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.6082983380180433

optimal path: ((0.6356066888924083, 0.5058254013788115), (0.720144445659883, 0.8203534989820102), (0.5060057739734626, 0.5842337164828938), (0.05094985066614366, 0.1938757519500467), (0.5430144971934259, 0.2829868625153098), (0.6872283916500034, 0.30159273630635774), (0.9788058739082659, 0.25707281234179735))

========== RANDOM SOLUTION ==========

random distance: 3.2301737300710194

random path: [(0.5430144971934259, 0.2829868625153098), (0.5060057739734626, 0.5842337164828938), (0.05094985066614366, 0.1938757519500467), (0.9788058739082659, 0.25707281234179735), (0.6872283916500034, 0.30159273630635774), (0.6356066888924083, 0.5058254013788115), (0.720144445659883, 0.8203534989820102)]

========== AI SOLUTIONS ==========

ai distance: 2.608298338018044

ai path: [(0.720144445659883, 0.8203534989820102), (0.6356066888924083, 0.5058254013788115), (0.9788058739082659, 0.25707281234179735), (0.6872283916500034, 0.30159273630635774), (0.5430144971934259, 0.2829868625153098), (0.05094985066614366, 0.1938757519500467), (0.5060057739734626, 0.5842337164828938)]

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========== ORIGINAL CITIES ==========

[(0.784718062075556, 0.5904331513700088), (0.806680229650599, 0.8028465446239018), (0.4231592012849976, 0.1151066347473334), (0.6347304619009269, 0.061841506671793), (0.05545792428904184, 0.8855258182608327), (0.21155890552953183, 0.21221318430444358), (0.1177883453299351, 0.4868643526284919)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.6634771321752435

optimal path: ((0.784718062075556, 0.5904331513700088), (0.806680229650599, 0.8028465446239018), (0.05545792428904184, 0.8855258182608327), (0.1177883453299351, 0.4868643526284919), (0.21155890552953183, 0.21221318430444358), (0.4231592012849976, 0.1151066347473334), (0.6347304619009269, 0.061841506671793))

========== RANDOM SOLUTION ==========

random distance: 4.01992135527369

random path: [(0.05545792428904184, 0.8855258182608327), (0.6347304619009269, 0.061841506671793), (0.784718062075556, 0.5904331513700088), (0.806680229650599, 0.8028465446239018), (0.4231592012849976, 0.1151066347473334), (0.1177883453299351, 0.4868643526284919), (0.21155890552953183, 0.21221318430444358)]

========== AI SOLUTIONS ==========

ai distance: 2.6634771321752435

ai path: [(0.4231592012849976, 0.1151066347473334), (0.6347304619009269, 0.061841506671793), (0.784718062075556, 0.5904331513700088), (0.806680229650599, 0.8028465446239018), (0.05545792428904184, 0.8855258182608327), (0.1177883453299351, 0.4868643526284919), (0.21155890552953183, 0.21221318430444358)]

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========== ORIGINAL CITIES ==========

[(0.3620592241683498, 0.8999248461372389), (0.48454088001215745, 0.35487529418260777), (0.2967418409735003, 0.5009639458065722), (0.8591443619618548, 0.007796039711648772), (0.7910937442033887, 0.47393162129085054), (0.03229759242238073, 0.7120498692583618), (0.5631448242260292, 0.4493120744660879)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.6602891816128516

optimal path: ((0.3620592241683498, 0.8999248461372389), (0.03229759242238073, 0.7120498692583618), (0.2967418409735003, 0.5009639458065722), (0.48454088001215745, 0.35487529418260777), (0.8591443619618548, 0.007796039711648772), (0.7910937442033887, 0.47393162129085054), (0.5631448242260292, 0.4493120744660879))

========== RANDOM SOLUTION ==========

random distance: 3.443504897709588

random path: [(0.5631448242260292, 0.4493120744660879), (0.3620592241683498, 0.8999248461372389), (0.03229759242238073, 0.7120498692583618), (0.7910937442033887, 0.47393162129085054), (0.2967418409735003, 0.5009639458065722), (0.48454088001215745, 0.35487529418260777), (0.8591443619618548, 0.007796039711648772)]

========== AI SOLUTIONS ==========

ai distance: 2.6602891816128516

ai path: [(0.48454088001215745, 0.35487529418260777), (0.2967418409735003, 0.5009639458065722), (0.03229759242238073, 0.7120498692583618), (0.3620592241683498, 0.8999248461372389), (0.5631448242260292, 0.4493120744660879), (0.7910937442033887, 0.47393162129085054), (0.8591443619618548, 0.007796039711648772)]

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========== ORIGINAL CITIES ==========

[(0.548464014471179, 0.6043715850899926), (0.3220484974131471, 0.06803764007233892), (0.3855716518849738, 0.6116136523122205), (0.9005736751659396, 0.43379473510629707), (0.6402373770997806, 0.8364639631876188), (0.5001073740694434, 0.9182163976377584), (0.6528051201051143, 0.09261962282963332)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.4229278817785267

optimal path: ((0.548464014471179, 0.6043715850899926), (0.5001073740694434, 0.9182163976377584), (0.6402373770997806, 0.8364639631876188), (0.9005736751659396, 0.43379473510629707), (0.6528051201051143, 0.09261962282963332), (0.3220484974131471, 0.06803764007233892), (0.3855716518849738, 0.6116136523122205))

========== RANDOM SOLUTION ==========

random distance: 2.9217672821041187

random path: [(0.6402373770997806, 0.8364639631876188), (0.3855716518849738, 0.6116136523122205), (0.548464014471179, 0.6043715850899926), (0.5001073740694434, 0.9182163976377584), (0.3220484974131471, 0.06803764007233892), (0.6528051201051143, 0.09261962282963332), (0.9005736751659396, 0.43379473510629707)]

========== AI SOLUTIONS ==========

ai distance: 2.4229278817785267

ai path: [(0.9005736751659396, 0.43379473510629707), (0.6528051201051143, 0.09261962282963332), (0.3220484974131471, 0.06803764007233892), (0.3855716518849738, 0.6116136523122205), (0.548464014471179, 0.6043715850899926), (0.5001073740694434, 0.9182163976377584), (0.6402373770997806, 0.8364639631876188)]

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========= ORIGINAL CITIES =========

[(0.7279373049611968, 0.4056817133638042), (0.4434480004142418, 0.7959319766297176), (0.3101276463956433, 0.5335039806899542), (0.09041018882159824, 0.8379380971134559), (0.7141851675691969, 0.9068669056290826), (0.38193021676920436, 0.9242181805173236), (0.4328098786040113, 0.13224287477596453)]

========= OPTIMAL SOLUTION =========

optimal distance: 2.4376182252709486

optimal path: ((0.09041018882159824, 0.8379380971134559), (0.38193021676920436, 0.9242181805173236), (0.4434480004142418, 0.7959319766297176), (0.7141851675691969, 0.9068669056290826), (0.7279373049611968, 0.4056817133638042), (0.4328098786040113, 0.13224287477596453), (0.3101276463956433, 0.5335039806899542))

========= RANDOM SOLUTION =========

random distance: 3.0454321892975518

random path: [(0.7141851675691969, 0.9068669056290826), (0.3101276463956433, 0.5335039806899542), (0.7279373049611968, 0.4056817133638042), (0.4328098786040113, 0.13224287477596453), (0.4434480004142418, 0.7959319766297176), (0.09041018882159824, 0.8379380971134559), (0.38193021676920436, 0.9242181805173236)]

========= AI SOLUTIONS =========

ai distance: 2.437618225270949

ai path: [(0.4434480004142418, 0.7959319766297176), (0.7141851675691969, 0.9068669056290826), (0.7279373049611968, 0.4056817133638042), (0.4328098786040113, 0.13224287477596453), (0.3101276463956433, 0.5335039806899542), (0.09041018882159824, 0.8379380971134559), (0.38193021676920436, 0.9242181805173236)]

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========= ORIGINAL CITIES =========

[(0.10220663142052577, 0.2775113800875634), (0.9479568114178616, 0.2224501372779082), (0.8972746907885911, 0.0012563820578684881), (0.5881954191547348, 0.8147661485607953), (0.29207732526407926, 0.27935489890828713), (0.442306394447899, 0.6697258222314529), (0.4966801230553275, 0.6645674531542183)]

========= OPTIMAL SOLUTION =========

optimal distance: 2.5254875718284295

optimal path: ((0.10220663142052577, 0.2775113800875634), (0.29207732526407926, 0.27935489890828713), (0.8972746907885911, 0.0012563820578684881), (0.9479568114178616, 0.2224501372779082), (0.5881954191547348, 0.8147661485607953), (0.4966801230553275, 0.6645674531542183), (0.442306394447899, 0.6697258222314529))

========= RANDOM SOLUTION =========

random distance: 3.509569131099332

random path: [(0.10220663142052577, 0.2775113800875634), (0.5881954191547348, 0.8147661485607953), (0.29207732526407926, 0.27935489890828713), (0.442306394447899, 0.6697258222314529), (0.4966801230553275, 0.6645674531542183), (0.9479568114178616, 0.2224501372779082), (0.8972746907885911, 0.0012563820578684881)]

========= AI SOLUTIONS =========

ai distance: 2.5254875718284295

ai path: [(0.29207732526407926, 0.27935489890828713), (0.10220663142052577, 0.2775113800875634), (0.442306394447899, 0.6697258222314529), (0.4966801230553275, 0.6645674531542183), (0.5881954191547348, 0.8147661485607953), (0.9479568114178616, 0.2224501372779082), (0.8972746907885911, 0.0012563820578684881)]

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========== ORIGINAL CITIES ==========

[(0.3261703400985968, 0.7808966274692261), (0.878699060495029, 0.503080480947636), (0.7388449272978647, 0.09064371476082744), (0.14445761262836376, 0.9137272358493175), (0.1969862091955108, 0.9110384314560391), (0.8855880241335704, 0.5819130145579795), (0.4191003025885276, 0.5275571617607104)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.3596473004908227

optimal path: ((0.878699060495029, 0.503080480947636), (0.7388449272978647, 0.09064371476082744), (0.4191003025885276, 0.5275571617607104), (0.14445761262836376, 0.9137272358493175), (0.1969862091955108, 0.9110384314560391), (0.3261703400985968, 0.7808966274692261), (0.8855880241335704, 0.5819130145579795))

========== RANDOM SOLUTION ==========

random distance: 4.953841632037491

random path: [(0.3261703400985968, 0.7808966274692261), (0.878699060495029, 0.503080480947636), (0.14445761262836376, 0.9137272358493175), (0.4191003025885276, 0.5275571617607104), (0.8855880241335704, 0.5819130145579795), (0.1969862091955108, 0.9110384314560391), (0.7388449272978647, 0.09064371476082744)]

========== AI SOLUTIONS ==========

ai distance: 2.359647300490823

ai path: [(0.4191003025885276, 0.5275571617607104), (0.14445761262836376, 0.9137272358493175), (0.1969862091955108, 0.9110384314560391), (0.3261703400985968, 0.7808966274692261), (0.8855880241335704, 0.5819130145579795), (0.878699060495029, 0.503080480947636), (0.7388449272978647, 0.09064371476082744)]

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========== ORIGINAL CITIES ==========

[(0.5912945736217998, 0.9072685788513807), (0.5733284560782294, 0.8880024850515786), (0.9827022766597657, 0.9150932240418265), (0.9396425717165037, 0.6460365784755693), (0.15797374117261387, 0.11117231118894833), (0.047124976066625024, 0.053993445052692435), (0.669649271392294, 0.7017550806399672)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.858262799216215

optimal path: ((0.669649271392294, 0.7017550806399672), (0.9396425717165037, 0.6460365784755693), (0.9827022766597657, 0.9150932240418265), (0.5912945736217998, 0.9072685788513807), (0.5733284560782294, 0.8880024850515786), (0.047124976066625024, 0.053993445052692435), (0.15797374117261387, 0.11117231118894833))

========== RANDOM SOLUTION ==========

random distance: 5.034568509811255

random path: [(0.9396425717165037, 0.6460365784755693), (0.5912945736217998, 0.9072685788513807), (0.9827022766597657, 0.9150932240418265), (0.047124976066625024, 0.053993445052692435), (0.669649271392294, 0.7017550806399672), (0.5733284560782294, 0.8880024850515786), (0.15797374117261387, 0.11117231118894833)]

========== AI SOLUTIONS ==========

ai distance: 2.858262799216215

ai path: [(0.669649271392294, 0.7017550806399672), (0.9396425717165037, 0.6460365784755693), (0.9827022766597657, 0.9150932240418265), (0.5912945736217998, 0.9072685788513807), (0.5733284560782294, 0.8880024850515786), (0.047124976066625024, 0.053993445052692435), (0.15797374117261387, 0.11117231118894833)]

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========== ORIGINAL CITIES ==========

[(0.09634805699443372, 0.16320087881138656), (0.4192657656090275, 0.3326750519443521), (0.30055013927604723, 0.8076703265932521), (0.40147097256171016, 0.4644178170229911), (0.03339342018132152, 0.29905340792205737), (0.45139290156601386, 0.4926020279409776), (0.85970670924877, 0.9762204520328206)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.4961409068546914

optimal path: ((0.4192657656090275, 0.3326750519443521), (0.09634805699443372, 0.16320087881138656), (0.03339342018132152, 0.29905340792205737), (0.30055013927604723, 0.8076703265932521), (0.85970670924877, 0.9762204520328206), (0.45139290156601386, 0.4926020279409776), (0.40147097256171016, 0.4644178170229911))

========== RANDOM SOLUTION ==========

random distance: 2.7492321599926943

random path: [(0.85970670924877, 0.9762204520328206), (0.40147097256171016, 0.4644178170229911), (0.09634805699443372, 0.16320087881138656), (0.03339342018132152, 0.29905340792205737), (0.4192657656090275, 0.3326750519443521), (0.45139290156601386, 0.4926020279409776), (0.30055013927604723, 0.8076703265932521)]

========== AI SOLUTIONS ==========

ai distance: 2.4961409068546914

ai path: [(0.85970670924877, 0.9762204520328206), (0.45139290156601386, 0.4926020279409776), (0.40147097256171016, 0.4644178170229911), (0.4192657656090275, 0.3326750519443521), (0.09634805699443372, 0.16320087881138656), (0.03339342018132152, 0.29905340792205737), (0.30055013927604723, 0.8076703265932521)]

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========== ORIGINAL CITIES ==========

[(0.4886819491602673, 0.12972468651864022), (0.2988110148409935, 0.5645140710308311), (0.002070245627621703, 0.8629439295983822), (0.9759682657603701, 0.9174983213772366), (0.5646058438112634, 0.6468638386327081), (0.19383375695192295, 0.14739361941650653), (0.694627940982707, 0.40140931945961)]

========== OPTIMAL SOLUTION ==========

optimal distance: 3.15640495613307

optimal path: ((0.2988110148409935, 0.5645140710308311), (0.002070245627621703, 0.8629439295983822), (0.19383375695192295, 0.14739361941650653), (0.4886819491602673, 0.12972468651864022), (0.694627940982707, 0.40140931945961), (0.9759682657603701, 0.9174983213772366), (0.5646058438112634, 0.6468638386327081))

========== RANDOM SOLUTION ==========

random distance: 4.638542930122129

random path: [(0.5646058438112634, 0.6468638386327081), (0.4886819491602673, 0.12972468651864022), (0.002070245627621703, 0.8629439295983822), (0.694627940982707, 0.40140931945961), (0.9759682657603701, 0.9174983213772366), (0.2988110148409935, 0.5645140710308311), (0.19383375695192295, 0.14739361941650653)]

========== AI SOLUTIONS ==========

ai distance: 3.1564049561330703

ai path: [(0.4886819491602673, 0.12972468651864022), (0.694627940982707, 0.40140931945961), (0.9759682657603701, 0.9174983213772366), (0.5646058438112634, 0.6468638386327081), (0.2988110148409935, 0.5645140710308311), (0.002070245627621703, 0.8629439295983822), (0.19383375695192295, 0.14739361941650653)]

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========== ORIGINAL CITIES ==========

[(0.2644901821006914, 0.04628379028992258), (0.1226765974174796, 0.6079850656045979), (0.997493960756632, 0.9107418116130679), (0.027271315022722065, 0.3765175988569528), (0.9444708776133054, 0.8105553099160288), (0.8202799162331947, 0.5481243150098238), (0.7154015179850118, 0.648489600089725)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.788751142365738

optimal path: ((0.2644901821006914, 0.04628379028992258), (0.8202799162331947, 0.5481243150098238), (0.9444708776133054, 0.8105553099160288), (0.997493960756632, 0.9107418116130679), (0.7154015179850118, 0.648489600089725), (0.1226765974174796, 0.6079850656045979), (0.027271315022722065, 0.3765175988569528))

========== RANDOM SOLUTION ==========

random distance: 4.376145920381961

random path: [(0.027271315022722065, 0.3765175988569528), (0.9444708776133054, 0.8105553099160288), (0.7154015179850118, 0.648489600089725), (0.2644901821006914, 0.04628379028992258), (0.8202799162331947, 0.5481243150098238), (0.997493960756632, 0.9107418116130679), (0.1226765974174796, 0.6079850656045979)]

========== AI SOLUTIONS ==========

ai distance: 2.788751142365738

ai path: [(0.7154015179850118, 0.648489600089725), (0.997493960756632, 0.9107418116130679), (0.9444708776133054, 0.8105553099160288), (0.8202799162331947, 0.5481243150098238), (0.2644901821006914, 0.04628379028992258), (0.027271315022722065, 0.3765175988569528), (0.1226765974174796, 0.6079850656045979)]

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========== ORIGINAL CITIES ==========

[(0.48235799932205015, 0.375817649990412), (0.553951364819053, 0.6567585258292855), (0.6195747864693113, 0.8990698841495774), (0.23023540179961932, 0.09853095950577861), (0.5670110371986432, 0.2024601583068305), (0.46217641485193084, 0.7483316085061806), (0.15265124334430902, 0.31130443374022854)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.0662786133652054

optimal path: ((0.6195747864693113, 0.8990698841495774), (0.553951364819053, 0.6567585258292855), (0.48235799932205015, 0.375817649990412), (0.5670110371986432, 0.2024601583068305), (0.23023540179961932, 0.09853095950577861), (0.15265124334430902, 0.31130443374022854), (0.46217641485193084, 0.7483316085061806))

========== RANDOM SOLUTION ==========

random distance: 3.3688778038083766

random path: [(0.15265124334430902, 0.31130443374022854), (0.5670110371986432, 0.2024601583068305), (0.553951364819053, 0.6567585258292855), (0.46217641485193084, 0.7483316085061806), (0.23023540179961932, 0.09853095950577861), (0.48235799932205015, 0.375817649990412), (0.6195747864693113, 0.8990698841495774)]

========== AI SOLUTIONS ==========

ai distance: 2.0662786133652054

ai path: [(0.6195747864693113, 0.8990698841495774), (0.553951364819053, 0.6567585258292855), (0.48235799932205015, 0.375817649990412), (0.5670110371986432, 0.2024601583068305), (0.23023540179961932, 0.09853095950577861), (0.15265124334430902, 0.31130443374022854), (0.46217641485193084, 0.7483316085061806)]

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========= ORIGINAL CITIES =========

[(0.7807048785936143, 0.8900851476267218), (0.33865340303248204, 0.7972139365366582), (0.5053152522864652, 0.9121940868414821), (0.5139172575028295, 0.5984483943324123), (0.3291992887723383, 0.16892699247637377), (0.1343108684097435, 0.6699976901745401), (0.7186113925102804, 0.36530248294632106)]

========= OPTIMAL SOLUTION =========

optimal distance: 2.3987298260755447

optimal path: ((0.7807048785936143, 0.8900851476267218), (0.5053152522864652, 0.9121940868414821), (0.33865340303248204, 0.7972139365366582), (0.1343108684097435, 0.6699976901745401), (0.3291992887723383, 0.16892699247637377), (0.7186113925102804, 0.36530248294632106), (0.5139172575028295, 0.5984483943324123))

========= RANDOM SOLUTION =========

random distance: 3.3703963772464007

random path: [(0.1343108684097435, 0.6699976901745401), (0.5053152522864652, 0.9121940868414821), (0.5139172575028295, 0.5984483943324123), (0.3291992887723383, 0.16892699247637377), (0.7186113925102804, 0.36530248294632106), (0.33865340303248204, 0.7972139365366582), (0.7807048785936143, 0.8900851476267218)]

========= AI SOLUTIONS =========

ai distance: 2.5378746274024517

ai path: [(0.7186113925102804, 0.36530248294632106), (0.3291992887723383, 0.16892699247637377), (0.5139172575028295, 0.5984483943324123), (0.1343108684097435, 0.6699976901745401), (0.33865340303248204, 0.7972139365366582), (0.5053152522864652, 0.9121940868414821), (0.7807048785936143, 0.8900851476267218)]

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========= ORIGINAL CITIES =========

[(0.01674234203895264, 0.2998751004949115), (0.7825197701267743, 0.08150628960359074), (0.9357219355970547, 0.6329363589909431), (0.13175880964586673, 0.07353120408076308), (0.12725200836123307, 0.8060717006814566), (0.572150785242937, 0.7965168311912201), (0.5342237870325787, 0.5526666067178609)]

========= OPTIMAL SOLUTION =========

optimal distance: 3.0963626571099994

optimal path: ((0.572150785242937, 0.7965168311912201), (0.12725200836123307, 0.8060717006814566), (0.01674234203895264, 0.2998751004949115), (0.13175880964586673, 0.07353120408076308), (0.7825197701267743, 0.08150628960359074), (0.9357219355970547, 0.6329363589909431), (0.5342237870325787, 0.5526666067178609))

========= RANDOM SOLUTION =========

random distance: 5.529368006332825

random path: [(0.9357219355970547, 0.6329363589909431), (0.13175880964586673, 0.07353120408076308), (0.5342237870325787, 0.5526666067178609), (0.12725200836123307, 0.8060717006814566), (0.7825197701267743, 0.08150628960359074), (0.572150785242937, 0.7965168311912201), (0.01674234203895264, 0.2998751004949115)]

========= AI SOLUTIONS =========

ai distance: 3.09636265711

ai path: [(0.12725200836123307, 0.8060717006814566), (0.572150785242937, 0.7965168311912201), (0.5342237870325787, 0.5526666067178609), (0.9357219355970547, 0.6329363589909431), (0.7825197701267743, 0.08150628960359074), (0.13175880964586673, 0.07353120408076308), (0.01674234203895264, 0.2998751004949115)]

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========== ORIGINAL CITIES ==========

[(0.38334713609753857, 0.9194252218791795), (0.35469068377538826, 0.10192911805182092), (0.21973615939142832, 0.9089016840619685), (0.11424546623166731, 0.07332535452091127), (0.21313960846422386, 0.8716182287084403), (0.9491350296892843, 0.539909130127943), (0.22937594975067876, 0.573222869460736)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.6754275261538387

optimal path: ((0.38334713609753857, 0.9194252218791795), (0.21973615939142832, 0.9089016840619685), (0.21313960846422386, 0.8716182287084403), (0.22937594975067876, 0.573222869460736), (0.11424546623166731, 0.07332535452091127), (0.35469068377538826, 0.10192911805182092), (0.9491350296892843, 0.539909130127943))

========== RANDOM SOLUTION ==========

random distance: 3.4530785000528583

random path: [(0.11424546623166731, 0.07332535452091127), (0.38334713609753857, 0.9194252218791795), (0.9491350296892843, 0.539909130127943), (0.21973615939142832, 0.9089016840619685), (0.21313960846422386, 0.8716182287084403), (0.22937594975067876, 0.573222869460736), (0.35469068377538826, 0.10192911805182092)]

========== AI SOLUTIONS ==========

ai distance: 2.6754275261538387

ai path: [(0.11424546623166731, 0.07332535452091127), (0.22937594975067876, 0.573222869460736), (0.21313960846422386, 0.8716182287084403), (0.21973615939142832, 0.9089016840619685), (0.38334713609753857, 0.9194252218791795), (0.9491350296892843, 0.539909130127943), (0.35469068377538826, 0.10192911805182092)]

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========== ORIGINAL CITIES ==========

[(0.27365978707990213, 0.7388947646897019), (0.319707170673033, 0.9006796655893243), (0.9672883508549852, 0.4730732938273542), (0.5992949778072632, 0.7955014443479046), (0.7469333869462901, 0.43254845286985144), (0.02277522868785231, 0.6107555533871536), (0.05654467628146265, 0.48603289326210464)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.283626088624701

optimal path: ((0.02277522868785231, 0.6107555533871536), (0.27365978707990213, 0.7388947646897019), (0.319707170673033, 0.9006796655893243), (0.5992949778072632, 0.7955014443479046), (0.9672883508549852, 0.4730732938273542), (0.7469333869462901, 0.43254845286985144), (0.05654467628146265, 0.48603289326210464))

========== RANDOM SOLUTION ==========

random distance: 3.8068452755585325

random path: [(0.7469333869462901, 0.43254845286985144), (0.05654467628146265, 0.48603289326210464), (0.319707170673033, 0.9006796655893243), (0.9672883508549852, 0.4730732938273542), (0.5992949778072632, 0.7955014443479046), (0.27365978707990213, 0.7388947646897019), (0.02277522868785231, 0.6107555533871536)]

========== AI SOLUTIONS ==========

ai distance: 2.2836260886247013

ai path: [(0.27365978707990213, 0.7388947646897019), (0.319707170673033, 0.9006796655893243), (0.5992949778072632, 0.7955014443479046), (0.9672883508549852, 0.4730732938273542), (0.7469333869462901, 0.43254845286985144), (0.05654467628146265, 0.48603289326210464), (0.02277522868785231, 0.6107555533871536)]

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========= ORIGINAL CITIES =========

[(0.729263669755688, 0.6332951380465999), (0.9516579338602299, 0.4071177386987349), (0.8507909062744801, 0.08021771255200916), (0.8140198546288202, 0.26409042163367247), (0.3596194524588231, 0.48537265267184715), (0.4292830067603237, 0.663069716124751), (0.6438271465326476, 0.8795247130089868)]

========= OPTIMAL SOLUTION =========

optimal distance: 2.09618067584465

optimal path: ((0.729263669755688, 0.6332951380465999), (0.9516579338602299, 0.4071177386987349), (0.8140198546288202, 0.26409042163367247), (0.8507909062744801, 0.08021771255200916), (0.3596194524588231, 0.48537265267184715), (0.4292830067603237, 0.663069716124751), (0.6438271465326476, 0.8795247130089868))

========= RANDOM SOLUTION =========

random distance: 3.2845483787257796

random path: [(0.8140198546288202, 0.26409042163367247), (0.9516579338602299, 0.4071177386987349), (0.6438271465326476, 0.8795247130089868), (0.3596194524588231, 0.48537265267184715), (0.8507909062744801, 0.08021771255200916), (0.4292830067603237, 0.663069716124751), (0.729263669755688, 0.6332951380465999)]

========= AI SOLUTIONS =========

ai distance: 2.09618067584465

ai path: [(0.9516579338602299, 0.4071177386987349), (0.8140198546288202, 0.26409042163367247), (0.8507909062744801, 0.08021771255200916), (0.3596194524588231, 0.48537265267184715), (0.4292830067603237, 0.663069716124751), (0.6438271465326476, 0.8795247130089868), (0.729263669755688, 0.6332951380465999)]

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========= ORIGINAL CITIES =========

[(0.40235213934666103, 0.10836708371769144), (0.10119741514818037, 0.09160158825974529), (0.7756286832678846, 0.680318799637636), (0.03103519557568435, 0.6228754234910184), (0.831130236108151, 0.07598890170474337), (0.88062318245783, 0.9335132115509615), (0.32670675909936464, 0.7090965858957654)]

========= OPTIMAL SOLUTION =========

optimal distance: 3.05411784249567

optimal path: ((0.40235213934666103, 0.10836708371769144), (0.10119741514818037, 0.09160158825974529), (0.03103519557568435, 0.6228754234910184), (0.32670675909936464, 0.7090965858957654), (0.88062318245783, 0.9335132115509615), (0.7756286832678846, 0.680318799637636), (0.831130236108151, 0.07598890170474337))

========= RANDOM SOLUTION =========

random distance: 4.685394758241747

random path: [(0.88062318245783, 0.9335132115509615), (0.03103519557568435, 0.6228754234910184), (0.7756286832678846, 0.680318799637636), (0.10119741514818037, 0.09160158825974529), (0.40235213934666103, 0.10836708371769144), (0.831130236108151, 0.07598890170474337), (0.32670675909936464, 0.7090965858957654)]

========= AI SOLUTIONS =========

ai distance: 3.05411784249567

ai path: [(0.88062318245783, 0.9335132115509615), (0.7756286832678846, 0.680318799637636), (0.831130236108151, 0.07598890170474337), (0.40235213934666103, 0.10836708371769144), (0.10119741514818037, 0.09160158825974529), (0.03103519557568435, 0.6228754234910184), (0.32670675909936464, 0.7090965858957654)]

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========== ORIGINAL CITIES ==========

[(0.3112547600301301, 0.24263548394143253), (0.6030789204199383, 0.2031437827758541), (0.6918443639425446, 0.13693556847324262), (0.07814663931320587, 0.8128008755292332), (0.9165111002976523, 0.7192679619806035), (0.04158992240318704, 0.5784985462331945), (0.9589289610762168, 0.3551006462971229)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.628140658478301

optimal path: ((0.9589289610762168, 0.3551006462971229), (0.6918443639425446, 0.13693556847324262), (0.6030789204199383, 0.2031437827758541), (0.3112547600301301, 0.24263548394143253), (0.04158992240318704, 0.5784985462331945), (0.07814663931320587, 0.8128008755292332), (0.9165111002976523, 0.7192679619806035))

========== RANDOM SOLUTION ==========

random distance: 3.8968953202161996

random path: [(0.6918443639425446, 0.13693556847324262), (0.9165111002976523, 0.7192679619806035), (0.9589289610762168, 0.3551006462971229), (0.04158992240318704, 0.5784985462331945), (0.3112547600301301, 0.24263548394143253), (0.07814663931320587, 0.8128008755292332), (0.6030789204199383, 0.2031437827758541)]

========== AI SOLUTIONS ==========

ai distance: 2.6281406584783014

ai path: [(0.6918443639425446, 0.13693556847324262), (0.9589289610762168, 0.3551006462971229), (0.9165111002976523, 0.7192679619806035), (0.07814663931320587, 0.8128008755292332), (0.04158992240318704, 0.5784985462331945), (0.3112547600301301, 0.24263548394143253), (0.6030789204199383, 0.2031437827758541)]

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========== ORIGINAL CITIES ==========

[(0.2660809075750532, 0.7004772973757624), (0.05494011664605425, 0.1829704948596067), (0.5617166936221333, 0.272722485469335), (0.24300748904527925, 0.018511156056662537), (0.7866223944303175, 0.0018707035129632565), (0.18190472512917, 0.2671820294605186), (0.04778355112565402, 0.7679748195906999)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.565022973423714

optimal path: ((0.2660809075750532, 0.7004772973757624), (0.04778355112565402, 0.7679748195906999), (0.18190472512917, 0.2671820294605186), (0.05494011664605425, 0.1829704948596067), (0.24300748904527925, 0.018511156056662537), (0.7866223944303175, 0.0018707035129632565), (0.5617166936221333, 0.272722485469335))

========== RANDOM SOLUTION ==========

random distance: 3.411380962720683

random path: [(0.5617166936221333, 0.272722485469335), (0.24300748904527925, 0.018511156056662537), (0.18190472512917, 0.2671820294605186), (0.7866223944303175, 0.0018707035129632565), (0.05494011664605425, 0.1829704948596067), (0.04778355112565402, 0.7679748195906999), (0.2660809075750532, 0.7004772973757624)]

========== AI SOLUTIONS ==========

ai distance: 2.565022973423714

ai path: [(0.5617166936221333, 0.272722485469335), (0.7866223944303175, 0.0018707035129632565), (0.24300748904527925, 0.018511156056662537), (0.05494011664605425, 0.1829704948596067), (0.18190472512917, 0.2671820294605186), (0.04778355112565402, 0.7679748195906999), (0.2660809075750532, 0.7004772973757624)]

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========== ORIGINAL CITIES ==========

[(0.03715477054013294, 0.2606454117478778), (0.25217352449852815, 0.8534392692855549), (0.17494991356263956, 0.27011121443742103), (0.09107882136678369, 0.3719407272887134), (0.9337518877105672, 0.2823139917038102), (0.9472048233146162, 0.6770319331497806), (0.5943458959269736, 0.45343721593856834)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.7193573243666145

optimal path: ((0.03715477054013294, 0.2606454117478778), (0.09107882136678369, 0.3719407272887134), (0.25217352449852815, 0.8534392692855549), (0.9472048233146162, 0.6770319331497806), (0.9337518877105672, 0.2823139917038102), (0.5943458959269736, 0.45343721593856834), (0.17494991356263956, 0.27011121443742103))

========== RANDOM SOLUTION ==========

random distance: 4.305826949894488

random path: [(0.5943458959269736, 0.45343721593856834), (0.9472048233146162, 0.6770319331497806), (0.17494991356263956, 0.27011121443742103), (0.03715477054013294, 0.2606454117478778), (0.25217352449852815, 0.8534392692855549), (0.9337518877105672, 0.2823139917038102), (0.09107882136678369, 0.3719407272887134)]

========== AI SOLUTIONS ==========

ai distance: 2.7193573243666145

ai path: [(0.03715477054013294, 0.2606454117478778), (0.09107882136678369, 0.3719407272887134), (0.25217352449852815, 0.8534392692855549), (0.9472048233146162, 0.6770319331497806), (0.9337518877105672, 0.2823139917038102), (0.5943458959269736, 0.45343721593856834), (0.17494991356263956, 0.27011121443742103)]

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========== ORIGINAL CITIES ==========

[(0.23672517035178875, 0.5614173483146258), (0.6168825899356398, 0.9339994424029489), (0.9953681820435949, 0.8731496092034454), (0.3592835034452878, 0.9957264276707356), (0.3479823567482019, 0.7254365096544323), (0.36689175717361733, 0.9351040746541327), (0.9281792315415958, 0.04371934700791591)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.813976281549884

optimal path: ((0.23672517035178875, 0.5614173483146258), (0.3479823567482019, 0.7254365096544323), (0.36689175717361733, 0.9351040746541327), (0.3592835034452878, 0.9957264276707356), (0.6168825899356398, 0.9339994424029489), (0.9953681820435949, 0.8731496092034454), (0.9281792315415958, 0.04371934700791591))

========== RANDOM SOLUTION ==========

random distance: 4.51033028341763

random path: [(0.3479823567482019, 0.7254365096544323), (0.3592835034452878, 0.9957264276707356), (0.23672517035178875, 0.5614173483146258), (0.9953681820435949, 0.8731496092034454), (0.36689175717361733, 0.9351040746541327), (0.9281792315415958, 0.04371934700791591), (0.6168825899356398, 0.9339994424029489)]

========== AI SOLUTIONS ==========

ai distance: 2.813976281549884

ai path: [(0.9953681820435949, 0.8731496092034454), (0.9281792315415958, 0.04371934700791591), (0.23672517035178875, 0.5614173483146258), (0.3479823567482019, 0.7254365096544323), (0.36689175717361733, 0.9351040746541327), (0.3592835034452878, 0.9957264276707356), (0.6168825899356398, 0.9339994424029489)]

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========== ORIGINAL CITIES ==========

[(0.3397322495355626, 0.32301470694454026), (0.6032210282806204, 0.9798119137997686), (0.36918104351096726, 0.42716298540971), (0.9519831854975841, 0.711750691933924), (0.44851978571133266, 0.6687444007905348), (0.5367968198740283, 0.5675384212938422), (0.8066343111244058, 0.5880720685943664)]

========== OPTIMAL SOLUTION ==========

optimal distance: 1.9253103539498855

optimal path: ((0.3397322495355626, 0.32301470694454026), (0.36918104351096726, 0.42716298540971), (0.44851978571133266, 0.6687444007905348), (0.6032210282806204, 0.9798119137997686), (0.9519831854975841, 0.711750691933924), (0.8066343111244058, 0.5880720685943664), (0.5367968198740283, 0.5675384212938422))

========== RANDOM SOLUTION ==========

random distance: 2.0820103761453157

random path: [(0.3397322495355626, 0.32301470694454026), (0.8066343111244058, 0.5880720685943664), (0.9519831854975841, 0.711750691933924), (0.6032210282806204, 0.9798119137997686), (0.5367968198740283, 0.5675384212938422), (0.44851978571133266, 0.6687444007905348), (0.36918104351096726, 0.42716298540971)]

========== AI SOLUTIONS ==========

ai distance: 1.9253103539498855

ai path: [(0.3397322495355626, 0.32301470694454026), (0.36918104351096726, 0.42716298540971), (0.44851978571133266, 0.6687444007905348), (0.6032210282806204, 0.9798119137997686), (0.9519831854975841, 0.711750691933924), (0.8066343111244058, 0.5880720685943664), (0.5367968198740283, 0.5675384212938422)]

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========== ORIGINAL CITIES ==========

[(0.6548684959381347, 0.5505407911879637), (0.09267610723490327, 0.2842462561803175), (0.9774958695174881, 0.5629144447762026), (0.9186147140297383, 0.052053917910197756), (0.1134315054863082, 0.9348843611007148), (0.40497997476632164, 0.11085712752104604), (0.9672833041749679, 0.9528815119244507)]

========== OPTIMAL SOLUTION ==========

optimal distance: 3.602886452745925

optimal path: ((0.6548684959381347, 0.5505407911879637), (0.9672833041749679, 0.9528815119244507), (0.9774958695174881, 0.5629144447762026), (0.9186147140297383, 0.052053917910197756), (0.40497997476632164, 0.11085712752104604), (0.09267610723490327, 0.2842462561803175), (0.1134315054863082, 0.9348843611007148))

========== RANDOM SOLUTION ==========

random distance: 4.464491857466424

random path: [(0.9774958695174881, 0.5629144447762026), (0.9186147140297383, 0.052053917910197756), (0.6548684959381347, 0.5505407911879637), (0.1134315054863082, 0.9348843611007148), (0.40497997476632164, 0.11085712752104604), (0.09267610723490327, 0.2842462561803175), (0.9672833041749679, 0.9528815119244507)]

========== AI SOLUTIONS ==========

ai distance: 3.6028864527459254

ai path: [(0.9672833041749679, 0.9528815119244507), (0.6548684959381347, 0.5505407911879637), (0.1134315054863082, 0.9348843611007148), (0.09267610723490327, 0.2842462561803175), (0.40497997476632164, 0.11085712752104604), (0.9186147140297383, 0.052053917910197756), (0.9774958695174881, 0.5629144447762026)]

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========== ORIGINAL CITIES ==========

[(0.05538427064561946, 0.4107192470708819), (0.6163382713132776, 0.23921554204305084), (0.6559028053769608, 0.7613519667922828), (0.9239520098156278, 0.05209432268629233), (0.6573794577219325, 0.15181529911439284), (0.0939350530075228, 0.7682341787733828), (0.10188030484837307, 0.1131183772703076)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.891884882602636

optimal path: ((0.05538427064561946, 0.4107192470708819), (0.10188030484837307, 0.1131183772703076), (0.6163382713132776, 0.23921554204305084), (0.6573794577219325, 0.15181529911439284), (0.9239520098156278, 0.05209432268629233), (0.6559028053769608, 0.7613519667922828), (0.0939350530075228, 0.7682341787733828))

========== RANDOM SOLUTION ==========

random distance: 4.082980318116825

random path: [(0.6573794577219325, 0.15181529911439284), (0.6559028053769608, 0.7613519667922828), (0.9239520098156278, 0.05209432268629233), (0.6163382713132776, 0.23921554204305084), (0.0939350530075228, 0.7682341787733828), (0.10188030484837307, 0.1131183772703076), (0.05538427064561946, 0.4107192470708819)]

========== AI SOLUTIONS ==========

ai distance: 2.891884882602636

ai path: [(0.0939350530075228, 0.7682341787733828), (0.6559028053769608, 0.7613519667922828), (0.9239520098156278, 0.05209432268629233), (0.6573794577219325, 0.15181529911439284), (0.6163382713132776, 0.23921554204305084), (0.10188030484837307, 0.1131183772703076), (0.05538427064561946, 0.4107192470708819)]

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========== ORIGINAL CITIES ==========

[(0.2384584461366256, 0.3794719866541103), (0.26669936829418006, 0.6235562209521934), (0.1942276045718332, 0.6786357233786845), (0.8374060590919463, 0.5348682333897985), (0.4511538678707917, 0.4935776894629448), (0.04685597298482769, 0.8460990566330655), (0.4616394298845695, 0.5242803892392434)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.0430362277790977

optimal path: ((0.2384584461366256, 0.3794719866541103), (0.04685597298482769, 0.8460990566330655), (0.1942276045718332, 0.6786357233786845), (0.26669936829418006, 0.6235562209521934), (0.4616394298845695, 0.5242803892392434), (0.8374060590919463, 0.5348682333897985), (0.4511538678707917, 0.4935776894629448))

========== RANDOM SOLUTION ==========

random distance: 2.6349623222443186

random path: [(0.2384584461366256, 0.3794719866541103), (0.04685597298482769, 0.8460990566330655), (0.8374060590919463, 0.5348682333897985), (0.4511538678707917, 0.4935776894629448), (0.1942276045718332, 0.6786357233786845), (0.26669936829418006, 0.6235562209521934), (0.4616394298845695, 0.5242803892392434)]

========== AI SOLUTIONS ==========

ai distance: 2.0430362277790977

ai path: [(0.2384584461366256, 0.3794719866541103), (0.04685597298482769, 0.8460990566330655), (0.1942276045718332, 0.6786357233786845), (0.26669936829418006, 0.6235562209521934), (0.4616394298845695, 0.5242803892392434), (0.8374060590919463, 0.5348682333897985), (0.4511538678707917, 0.4935776894629448)]

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========== ORIGINAL CITIES ==========

[(0.06469249502552721, 0.8186431996123623), (0.20410086405645111, 0.15413310873680852), (0.9157510373389969, 0.20386190687088857), (0.5620851110298704, 0.04551474857222726), (0.3725318075471792, 0.41810712341063394), (0.3457702979986529, 0.9648147388401899), (0.2799941220964428, 0.10540121570754746)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.851929344340069

optimal path: ((0.06469249502552721, 0.8186431996123623), (0.3725318075471792, 0.41810712341063394), (0.20410086405645111, 0.15413310873680852), (0.2799941220964428, 0.10540121570754746), (0.5620851110298704, 0.04551474857222726), (0.9157510373389969, 0.20386190687088857), (0.3457702979986529, 0.9648147388401899))

========== RANDOM SOLUTION ==========

random distance: 4.307613056789376

random path: [(0.5620851110298704, 0.04551474857222726), (0.3725318075471792, 0.41810712341063394), (0.06469249502552721, 0.8186431996123623), (0.20410086405645111, 0.15413310873680852), (0.3457702979986529, 0.9648147388401899), (0.9157510373389969, 0.20386190687088857), (0.2799941220964428, 0.10540121570754746)]

========== AI SOLUTIONS ==========

ai distance: 2.8519293443400695

ai path: [(0.5620851110298704, 0.04551474857222726), (0.9157510373389969, 0.20386190687088857), (0.3457702979986529, 0.9648147388401899), (0.06469249502552721, 0.8186431996123623), (0.3725318075471792, 0.41810712341063394), (0.20410086405645111, 0.15413310873680852), (0.2799941220964428, 0.10540121570754746)]

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========== ORIGINAL CITIES ==========

[(0.5726940854293945, 0.591479466282581), (0.4218302953639177, 0.6396505452305884), (0.3866693443639575, 0.1350280011421502), (0.6790219531128153, 0.8940946222239835), (0.34496887238016294, 0.7865605545812379), (0.6517609068772721, 0.3131974234632606), (0.5787250396814134, 0.7675300452215433)]

========== OPTIMAL SOLUTION ==========

optimal distance: 1.968922076422025

optimal path: ((0.5726940854293945, 0.591479466282581), (0.5787250396814134, 0.7675300452215433), (0.6790219531128153, 0.8940946222239835), (0.34496887238016294, 0.7865605545812379), (0.4218302953639177, 0.6396505452305884), (0.3866693443639575, 0.1350280011421502), (0.6517609068772721, 0.3131974234632606))

========== RANDOM SOLUTION ==========

random distance: 2.2586505352289428

random path: [(0.3866693443639575, 0.1350280011421502), (0.6517609068772721, 0.3131974234632606), (0.5726940854293945, 0.591479466282581), (0.34496887238016294, 0.7865605545812379), (0.4218302953639177, 0.6396505452305884), (0.6790219531128153, 0.8940946222239835), (0.5787250396814134, 0.7675300452215433)]

========== AI SOLUTIONS ==========

ai distance: 1.968922076422025

ai path: [(0.6790219531128153, 0.8940946222239835), (0.34496887238016294, 0.7865605545812379), (0.4218302953639177, 0.6396505452305884), (0.3866693443639575, 0.1350280011421502), (0.6517609068772721, 0.3131974234632606), (0.5726940854293945, 0.591479466282581), (0.5787250396814134, 0.7675300452215433)]

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========== ORIGINAL CITIES ==========

[(0.5553252275959607, 0.7258315362224868), (0.40979118238312473, 0.37126396429812947), (0.10837271043483943, 0.13627708997625276), (0.6395257072718584, 0.25127298185809865), (0.8584543198528828, 0.1890869335285078), (0.015447007981772343, 0.136912806017515), (0.631995827300302, 0.4559449845158585)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.336534195178673

optimal path: ((0.6395257072718584, 0.25127298185809865), (0.10837271043483943, 0.13627708997625276), (0.015447007981772343, 0.136912806017515), (0.40979118238312473, 0.37126396429812947), (0.5553252275959607, 0.7258315362224868), (0.631995827300302, 0.4559449845158585), (0.8584543198528828, 0.1890869335285078))

========== RANDOM SOLUTION ==========

random distance: 3.6022347154341383

random path: [(0.015447007981772343, 0.136912806017515), (0.40979118238312473, 0.37126396429812947), (0.10837271043483943, 0.13627708997625276), (0.631995827300302, 0.4559449845158585), (0.6395257072718584, 0.25127298185809865), (0.5553252275959607, 0.7258315362224868), (0.8584543198528828, 0.1890869335285078)]

========== AI SOLUTIONS ==========

ai distance: 2.336534195178673

ai path: [(0.6395257072718584, 0.25127298185809865), (0.10837271043483943, 0.13627708997625276), (0.015447007981772343, 0.136912806017515), (0.40979118238312473, 0.37126396429812947), (0.5553252275959607, 0.7258315362224868), (0.631995827300302, 0.4559449845158585), (0.8584543198528828, 0.1890869335285078)]

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========== ORIGINAL CITIES ==========

[(0.4199881369581313, 0.03182768805583325), (0.13341586162806107, 0.1595922247080589), (0.5427370592775125, 0.48662198526383993), (0.03910432601463887, 0.6548008954694029), (0.622269848260843, 0.8579860742839116), (0.7436662307730384, 0.5805865743209481), (0.0290340745469152, 0.7198512172460186)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.48848638294437

optimal path: ((0.622269848260843, 0.8579860742839116), (0.7436662307730384, 0.5805865743209481), (0.5427370592775125, 0.48662198526383993), (0.4199881369581313, 0.03182768805583325), (0.13341586162806107, 0.1595922247080589), (0.03910432601463887, 0.6548008954694029), (0.0290340745469152, 0.7198512172460186))

========== RANDOM SOLUTION ==========

random distance: 4.572397260850975

random path: [(0.622269848260843, 0.8579860742839116), (0.4199881369581313, 0.03182768805583325), (0.0290340745469152, 0.7198512172460186), (0.13341586162806107, 0.1595922247080589), (0.7436662307730384, 0.5805865743209481), (0.03910432601463887, 0.6548008954694029), (0.5427370592775125, 0.48662198526383993)]

========== AI SOLUTIONS ==========

ai distance: 2.488486382919444

ai path: [(0.4199881369581313, 0.03182768805583325), (0.13341586162806107, 0.1595922247080589), (0.03910432601463887, 0.6548008954694029), (0.0290340745469152, 0.7198512172460186), (0.622269848260843, 0.8579860742839116), (0.7436662307730384, 0.5805865743209481), (0.5427370592775125, 0.48662198526383993)]

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========== ORIGINAL CITIES ==========

[(0.1423768188863288, 0.9545258359028943), (0.999352502630788, 0.13970431187917443), (0.8776802958151929, 0.12122822986202964), (0.6202775499414751, 0.4609509626244854), (0.7585049271644496, 0.5518056462064561), (0.22271142792894527, 0.8078539424463493), (0.19036756399166688, 0.9540044947670395)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.4655661632777868

optimal path: ((0.1423768188863288, 0.9545258359028943), (0.22271142792894527, 0.8078539424463493), (0.6202775499414751, 0.4609509626244854), (0.8776802958151929, 0.12122822986202964), (0.999352502630788, 0.13970431187917443), (0.7585049271644496, 0.5518056462064561), (0.19036756399166688, 0.9540044947670395))

========== RANDOM SOLUTION ==========

random distance: 4.8970533938707215

random path: [(0.7585049271644496, 0.5518056462064561), (0.22271142792894527, 0.8078539424463493), (0.6202775499414751, 0.4609509626244854), (0.19036756399166688, 0.9540044947670395), (0.8776802958151929, 0.12122822986202964), (0.999352502630788, 0.13970431187917443), (0.1423768188863288, 0.9545258359028943)]

========== AI SOLUTIONS ==========

ai distance: 2.4655661632777868

ai path: [(0.19036756399166688, 0.9540044947670395), (0.7585049271644496, 0.5518056462064561), (0.999352502630788, 0.13970431187917443), (0.8776802958151929, 0.12122822986202964), (0.6202775499414751, 0.4609509626244854), (0.22271142792894527, 0.8078539424463493), (0.1423768188863288, 0.9545258359028943)]

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========== ORIGINAL CITIES ==========

[(0.1581901074049923, 0.21492442442410575), (0.49252295909983845, 0.4851686137123724), (0.44719802821499666, 0.2084823486406573), (0.41941780645922155, 0.3381102782869112), (0.823946826220847, 0.35206263510445024), (0.6062316861226811, 0.6303369696652341), (0.6918582486635624, 0.8172701105811674)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.0189115721718567

optimal path: ((0.1581901074049923, 0.21492442442410575), (0.44719802821499666, 0.2084823486406573), (0.823946826220847, 0.35206263510445024), (0.6918582486635624, 0.8172701105811674), (0.6062316861226811, 0.6303369696652341), (0.49252295909983845, 0.4851686137123724), (0.41941780645922155, 0.3381102782869112))

========== RANDOM SOLUTION ==========

random distance: 2.7904938097794174

random path: [(0.41941780645922155, 0.3381102782869112), (0.1581901074049923, 0.21492442442410575), (0.49252295909983845, 0.4851686137123724), (0.6918582486635624, 0.8172701105811674), (0.823946826220847, 0.35206263510445024), (0.44719802821499666, 0.2084823486406573), (0.6062316861226811, 0.6303369696652341)]

========== AI SOLUTIONS ==========

ai distance: 2.0189115721718567

ai path: [(0.6918582486635624, 0.8172701105811674), (0.823946826220847, 0.35206263510445024), (0.44719802821499666, 0.2084823486406573), (0.1581901074049923, 0.21492442442410575), (0.41941780645922155, 0.3381102782869112), (0.49252295909983845, 0.4851686137123724), (0.6062316861226811, 0.6303369696652341)]

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========= ORIGINAL CITIES =========

[(0.27256186407691874, 0.6260636681002896), (0.4777252647149003, 0.6017116376289628), (0.7322910911926375, 0.8984077262295663), (0.08542755408657476, 0.22218718014991734), (0.21084245290293857, 0.8345938758847586), (0.7276612720118114, 0.5954106185908644), (0.2630956191203412, 0.6193835017916365)]

========= OPTIMAL SOLUTION =========

optimal distance: 2.288401915018578

optimal path: ((0.4777252647149003, 0.6017116376289628), (0.08542755408657476, 0.22218718014991734), (0.2630956191203412, 0.6193835017916365), (0.27256186407691874, 0.6260636681002896), (0.21084245290293857, 0.8345938758847586), (0.7322910911926375, 0.8984077262295663), (0.7276612720118114, 0.5954106185908644))

========= RANDOM SOLUTION =========

random distance: 2.9423599269015064

random path: [(0.4777252647149003, 0.6017116376289628), (0.2630956191203412, 0.6193835017916365), (0.7276612720118114, 0.5954106185908644), (0.7322910911926375, 0.8984077262295663), (0.27256186407691874, 0.6260636681002896), (0.08542755408657476, 0.22218718014991734), (0.21084245290293857, 0.8345938758847586)]

========= AI SOLUTIONS =========

ai distance: 2.288401915018578

ai path: [(0.7322910911926375, 0.8984077262295663), (0.7276612720118114, 0.5954106185908644), (0.4777252647149003, 0.6017116376289628), (0.08542755408657476, 0.22218718014991734), (0.2630956191203412, 0.6193835017916365), (0.27256186407691874, 0.6260636681002896), (0.21084245290293857, 0.8345938758847586)]

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========= ORIGINAL CITIES =========

[(0.4137921686649537, 0.8481698753672544), (0.7093278162211453, 0.2265532630205357), (0.27899596869854293, 0.7818991847665083), (0.7207640102444378, 0.10941110447177738), (0.10294034521346818, 0.9707021381210833), (0.6653120917414689, 0.19470393171793865), (0.16604444372352567, 0.4817777914757799)]

========= OPTIMAL SOLUTION =========

optimal distance: 2.384980350910088

optimal path: ((0.4137921686649537, 0.8481698753672544), (0.7093278162211453, 0.2265532630205357), (0.7207640102444378, 0.10941110447177738), (0.6653120917414689, 0.19470393171793865), (0.16604444372352567, 0.4817777914757799), (0.10294034521346818, 0.9707021381210833), (0.27899596869854293, 0.7818991847665083))

========= RANDOM SOLUTION =========

random distance: 4.677963530689206

random path: [(0.7207640102444378, 0.10941110447177738), (0.16604444372352567, 0.4817777914757799), (0.7093278162211453, 0.2265532630205357), (0.4137921686649537, 0.8481698753672544), (0.6653120917414689, 0.19470393171793865), (0.10294034521346818, 0.9707021381210833), (0.27899596869854293, 0.7818991847665083)]

========= AI SOLUTIONS =========

ai distance: 2.384980350910088

ai path: [(0.4137921686649537, 0.8481698753672544), (0.7093278162211453, 0.2265532630205357), (0.7207640102444378, 0.10941110447177738), (0.6653120917414689, 0.19470393171793865), (0.16604444372352567, 0.4817777914757799), (0.10294034521346818, 0.9707021381210833), (0.27899596869854293, 0.7818991847665083)]

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========== ORIGINAL CITIES ==========

[(0.9149202930384162, 0.871061286245151), (0.6241090304551948, 0.10427319828995674), (0.9212684823658136, 0.8971911935203076), (0.9720280296361234, 0.05077322870429446), (0.8521737073958661, 0.3094391545570917), (0.9799795618527648, 0.3239462580431416), (0.3673219357305838, 0.5451014012407467)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.5101165825944256

optimal path: ((0.9149202930384162, 0.871061286245151), (0.9212684823658136, 0.8971911935203076), (0.3673219357305838, 0.5451014012407467), (0.6241090304551948, 0.10427319828995674), (0.9720280296361234, 0.05077322870429446), (0.8521737073958661, 0.3094391545570917), (0.9799795618527648, 0.3239462580431416))

========== RANDOM SOLUTION ==========

random distance: 4.241000825291055

random path: [(0.3673219357305838, 0.5451014012407467), (0.9799795618527648, 0.3239462580431416), (0.8521737073958661, 0.3094391545570917), (0.6241090304551948, 0.10427319828995674), (0.9212684823658136, 0.8971911935203076), (0.9720280296361234, 0.05077322870429446), (0.9149202930384162, 0.871061286245151)]

========== AI SOLUTIONS ==========

ai distance: 2.5101165825944256

ai path: [(0.3673219357305838, 0.5451014012407467), (0.6241090304551948, 0.10427319828995674), (0.9720280296361234, 0.05077322870429446), (0.8521737073958661, 0.3094391545570917), (0.9799795618527648, 0.3239462580431416), (0.9149202930384162, 0.871061286245151), (0.9212684823658136, 0.8971911935203076)]

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========== ORIGINAL CITIES ==========

[(0.4683942427166051, 0.20538173387038972), (0.06015139967908201, 0.855660562372548), (0.6675136677593315, 0.01077152858864372), (0.8028293241874979, 0.3664122066720291), (0.4211295359031574, 0.5718717244397983), (0.6297330029250888, 0.6134135088650273), (0.8686092598635157, 0.060597711173830615)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.539707669650181

optimal path: ((0.4683942427166051, 0.20538173387038972), (0.06015139967908201, 0.855660562372548), (0.4211295359031574, 0.5718717244397983), (0.6297330029250888, 0.6134135088650273), (0.8028293241874979, 0.3664122066720291), (0.8686092598635157, 0.060597711173830615), (0.6675136677593315, 0.01077152858864372))

========== RANDOM SOLUTION ==========

random distance: 3.331194688197273

random path: [(0.6675136677593315, 0.01077152858864372), (0.4211295359031574, 0.5718717244397983), (0.6297330029250888, 0.6134135088650273), (0.06015139967908201, 0.855660562372548), (0.4683942427166051, 0.20538173387038972), (0.8686092598635157, 0.060597711173830615), (0.8028293241874979, 0.3664122066720291)]

========== AI SOLUTIONS ==========

ai distance: 2.539707669650181

ai path: [(0.8028293241874979, 0.3664122066720291), (0.6297330029250888, 0.6134135088650273), (0.4211295359031574, 0.5718717244397983), (0.06015139967908201, 0.855660562372548), (0.4683942427166051, 0.20538173387038972), (0.6675136677593315, 0.01077152858864372), (0.8686092598635157, 0.060597711173830615)]

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========== ORIGINAL CITIES ==========

[(0.42783267334761754, 0.4876369053716344), (0.6888966359368233, 0.6254640008682131), (0.4516422933361166, 0.46353653978774767), (0.5936280486244361, 0.14515893143377545), (0.1746282898493966, 0.34549563014562656), (0.05943358693360623, 0.29740513591158113), (0.7198426925686645, 0.9100710348874775)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.301382292258506

optimal path: ((0.42783267334761754, 0.4876369053716344), (0.1746282898493966, 0.34549563014562656), (0.05943358693360623, 0.29740513591158113), (0.5936280486244361, 0.14515893143377545), (0.6888966359368233, 0.6254640008682131), (0.7198426925686645, 0.9100710348874775), (0.4516422933361166, 0.46353653978774767))

========== RANDOM SOLUTION ==========

random distance: 3.452067210340984

random path: [(0.7198426925686645, 0.9100710348874775), (0.42783267334761754, 0.4876369053716344), (0.6888966359368233, 0.6254640008682131), (0.1746282898493966, 0.34549563014562656), (0.4516422933361166, 0.46353653978774767), (0.05943358693360623, 0.29740513591158113), (0.5936280486244361, 0.14515893143377545)]

========== AI SOLUTIONS ==========

ai distance: 2.301382292258506

ai path: [(0.6888966359368233, 0.6254640008682131), (0.7198426925686645, 0.9100710348874775), (0.4516422933361166, 0.46353653978774767), (0.42783267334761754, 0.4876369053716344), (0.1746282898493966, 0.34549563014562656), (0.05943358693360623, 0.29740513591158113), (0.5936280486244361, 0.14515893143377545)]

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========== ORIGINAL CITIES ==========

[(0.9057337989224965, 0.4656798185063995), (0.7218427595349552, 0.7490247120735086), (0.857384229247107, 0.24128934922115286), (0.20480236265409468, 0.45584235850723065), (0.5403784539130737, 0.163324869350698), (0.5112071868946969, 0.692930770157817), (0.77791411178974, 0.21271930034971287)]

========== OPTIMAL SOLUTION ==========

optimal distance: 1.94496342186451

optimal path: ((0.9057337989224965, 0.4656798185063995), (0.857384229247107, 0.24128934922115286), (0.77791411178974, 0.21271930034971287), (0.5403784539130737, 0.163324869350698), (0.20480236265409468, 0.45584235850723065), (0.5112071868946969, 0.692930770157817), (0.7218427595349552, 0.7490247120735086))

========== RANDOM SOLUTION ==========

random distance: 3.927017241033285

random path: [(0.857384229247107, 0.24128934922115286), (0.20480236265409468, 0.45584235850723065), (0.77791411178974, 0.21271930034971287), (0.5112071868946969, 0.692930770157817), (0.9057337989224965, 0.4656798185063995), (0.5403784539130737, 0.163324869350698), (0.7218427595349552, 0.7490247120735086)]

========== AI SOLUTIONS ==========

ai distance: 1.94496342186451

ai path: [(0.9057337989224965, 0.4656798185063995), (0.857384229247107, 0.24128934922115286), (0.77791411178974, 0.21271930034971287), (0.5403784539130737, 0.163324869350698), (0.20480236265409468, 0.45584235850723065), (0.5112071868946969, 0.692930770157817), (0.7218427595349552, 0.7490247120735086)]

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========== ORIGINAL CITIES ==========

[(0.5075681993928636, 0.9208033803502346), (0.9622129558818222, 0.67415766102935), (0.7634441991444182, 0.5402333307874279), (0.6803835138490791, 0.6349571313583844), (0.5961185784173392, 0.9799060499320021), (0.8351127822668403, 0.34792931628664603), (0.28238714231696493, 0.3162591985727381)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.3760797172315145

optimal path: ((0.7634441991444182, 0.5402333307874279), (0.6803835138490791, 0.6349571313583844), (0.5961185784173392, 0.9799060499320021), (0.5075681993928636, 0.9208033803502346), (0.28238714231696493, 0.3162591985727381), (0.8351127822668403, 0.34792931628664603), (0.9622129558818222, 0.67415766102935))

========== RANDOM SOLUTION ==========

random distance: 2.905625382143936

random path: [(0.5961185784173392, 0.9799060499320021), (0.5075681993928636, 0.9208033803502346), (0.9622129558818222, 0.67415766102935), (0.7634441991444182, 0.5402333307874279), (0.28238714231696493, 0.3162591985727381), (0.6803835138490791, 0.6349571313583844), (0.8351127822668403, 0.34792931628664603)]

========== AI SOLUTIONS ==========

ai distance: 2.376079717231515

ai path: [(0.28238714231696493, 0.3162591985727381), (0.5075681993928636, 0.9208033803502346), (0.5961185784173392, 0.9799060499320021), (0.6803835138490791, 0.6349571313583844), (0.7634441991444182, 0.5402333307874279), (0.9622129558818222, 0.67415766102935), (0.8351127822668403, 0.34792931628664603)]

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========== ORIGINAL CITIES ==========

[(0.006933572656536602, 0.33345432830810295), (0.27321558146481195, 0.844853811122069), (0.1525239811493676, 0.034974593246249075), (0.8195820083012019, 0.7683680430629561), (0.03810966310628128, 0.7460229567853691), (0.08335480136339135, 0.44596808624924), (0.5505701569524815, 0.20870340736321968)]

========== OPTIMAL SOLUTION ==========

optimal distance: 2.6335498076448873

optimal path: ((0.27321558146481195, 0.844853811122069), (0.8195820083012019, 0.7683680430629561), (0.5505701569524815, 0.20870340736321968), (0.1525239811493676, 0.034974593246249075), (0.006933572656536602, 0.33345432830810295), (0.08335480136339135, 0.44596808624924), (0.03810966310628128, 0.7460229567853691))

========== RANDOM SOLUTION ==========

random distance: 3.8157665644806222

random path: [(0.1525239811493676, 0.034974593246249075), (0.03810966310628128, 0.7460229567853691), (0.27321558146481195, 0.844853811122069), (0.08335480136339135, 0.44596808624924), (0.5505701569524815, 0.20870340736321968), (0.8195820083012019, 0.7683680430629561), (0.006933572656536602, 0.33345432830810295)]

========== AI SOLUTIONS ==========

ai distance: 2.6335498076448873

ai path: [(0.1525239811493676, 0.034974593246249075), (0.5505701569524815, 0.20870340736321968), (0.8195820083012019, 0.7683680430629561), (0.27321558146481195, 0.844853811122069), (0.03810966310628128, 0.7460229567853691), (0.08335480136339135, 0.44596808624924), (0.006933572656536602, 0.33345432830810295)]

======================================= FINAL STATS =======================================

========== OPTIMAL SOLUTIONS STATS ==========

{'mean': 2.4432349085582965, 'min': 1.397121188859637, 'max': 3.602886452745925, 'std': 0.3513613360988595}

========== RANDOM SOLUTIONS STATS ==========

{'mean': 3.602650495783112, 'min': 1.9934395671404106, 'max': 5.661186871758963, 'std': 0.7538414944553328}

========== AI SOLUTIONS STATS ==========

{'mean': 2.445095693715398, 'min': 1.397121188859637, 'max': 3.6028864527459254, 'std': 0.35127546933988923}

========== RANDOM FOUND OPTIMAL SOLUTION COUNT ==========

0

========== AI FOUND OPTIMAL SOLUTION COUNT ==========

97