Selecting best routes of Iraqi cities using Genetic Algorithem

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Abstract :

The Genetic Algorithms can be considered as modern active way for finding optimum solution for many engineering problems as where as electronics , power , communication engineering. This optimum location has been detected with a low number of iteration . this optimazation can be used for many civilian application such as location of electrical power station , location of communication center or other to reduce the price/ km for transmission line . this optimization problem have been run with a special genetic algorithm called (Gas play ground) with suitable genetic input file.

Introduction:

GA looks for the best solution among anumber of possible solutions. Genetic algogorithms operate on a population of solution represented by one point in the search space. Solving a problem usually means looking for some solution which will be the best among other. The space of all feasible solutions is call search space [1] .

The problem is that the search can be very complicated. One may not know where to look for a solution or where to start. There are many methodes can use for finding a suitable solution, but these methods not necessarily provide the best solution. Some of these methods are hill climbing, tabu search, simulated annealing and the genetic algorithms.[2] .

A genetic algorithm (GA) is a direct random search technique, which can find the global optimal solution is multidimensional search space. It is one of a relative new class of stochastic search algorithm. Stochastic algorithms are those that use probability to help guide their search [3 , 4] .

GA mechanisms:

The implimentation of the genetic algorithm follows the standared GA structure but it incorporates several less standared mechanisms [5].

1- <u>An automatic ‘ kick ‘ :</u>
A sensor in the program monitors the evolutionary process, and when it finds that there has not been any advance in the recent N generation (N is user definable, it gives the population a ‘ kick’ and scramble it a little (in a user defind mannar).

<u>2 – A kin – competition compensating factor :</u>

If a population contains identical individuals , only one of them receives the nominally calculated fitness. The others are assigned decreased fitness value. This helps to maintain diversity in the population, and reduces the danger of the whole population being taken by a single, relatively superior , individual .

3 – Memory :

Each individual in a population owns both solution string and memory string, where history data can be recorded.

4 – Pre & post breed function:

These two funcions are activated befor and after breeding take place. This enables adding any extra processing to the old population (pre Breed) or to the new population (post Breed) during the process of creating a new generation.

Optimization problems for baghdad city :

- **our optimization problem in baghdad is to find optimum position. This position can be used to build important plants (electrical power station, communication center , or other) to satisfy minimum cost / Km and shortest transmission lines for connection roughly all baghdad distributed sector with High voltage or communication lines that satisfy minimum losses in power.**
- **Calculation and computer simulation results for baghdad :**

1st step :

Dependably modern map for baghdad city has been used to choose the important sectors and to determine the mid – important point (its coordinate) of these roughly distributed sector (fig 1).

2nd step :

From the above map having important input data which are used to form important part for the input file to simulate. The input data have been obtained and normalized to be suitable for the graphic screen under the following explanations:

First: the allele's definition file of genes which correspond to suitable coordinates of the sectors of these cities.

Second: the selector point which consist of determined number of genes equal to the number of important sectors which are also refer to number of variable or mapping file (table 1)

3rd step :

The input file must be modified with new alleles definition file amd apping file (table 2 and table 3)

4th step:

GA parameter must be modified to a mode that permits the program to run in problem mode, read from input file.

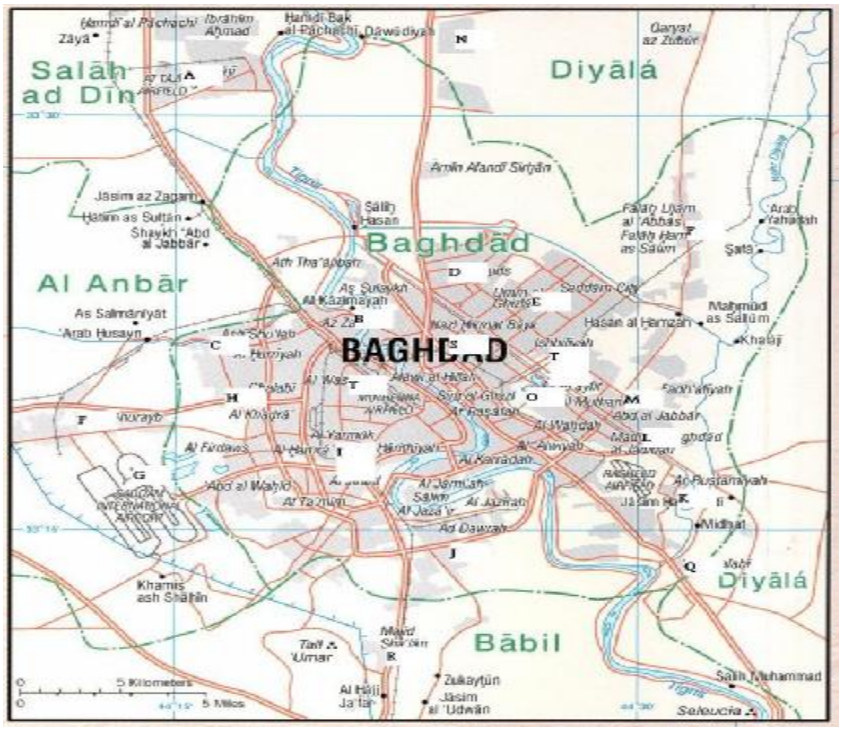


Fig 1 modern map for baghdad

Table (1) Genetics map for the important sectors for the Baghdad city.

City number in graphic	Name of city	Genetic code representation	(x , y) coordinates	Normalized (x , y) coordinates or alleles
City no. 0	Altaji	A	156 , 91	0.211 , 0.107
City no. 1	Alkazimayah	B	340 , 403	0.461 , 0.475
City no. 2	Alshuala	C	221 , 413	0.299 , 0.487
City no. 3	Alouds	D	432 , 350	0.585 , 0.412
City no. 4	Althurah city	E	506 , 352	0.686 , 0.415
City no. 5	Abu grayb	F	97 , 527	0.131 , 0.621
City no. 6	Airport	G	180 , 612	0.244 , 0.721
City no. 7	Alkadra	H	234 , 501	0.317 , 0.590
City no. 8	Alharithiya	I	300 , 527	0.407 , 0.621
City no. 9	Aldawrah	J	434 , 680	0.588 , 0.801
City no. 10	Alrustamiah	K	635 , 610	0.861 , 0.718
City no. 11	Baghdad Aljadedah	L	604 , 544	0.819 , 0.641
City no. 12	Almuthanna	M	585 , 503	0.793 , 0.593
City no. 13	Alrashdia	N	438 , 76	0.594 , 0.089
City no. 14	Souq Alghazel	O	500 , 500	0.678 , 0.589
City no. 15	Alaubayda	P	605 , 255	0.820 , 0.300
City no. 16	Hayy Diyala	Q	639 , 699	0.867 , 0.824
City no. 17	Alyusifiah	R	377 , 803	0.511 , 0.946
City no. 18	Alaadamiyah	S	433 , 438	0.587 , 0.516
City no. 19	Muthanna Air field	T	333 , 463	0.451 , 0.545

Table (2) list of parameters for the current problem

Title	Steiner's problem (input from file)
Description	Find a point where the distance sum to all cities is minimal
Integer	
Problem code	6
GA type	1
Min Max type	2
Genes number	20
Population size	20
Map orded	3
Stagnation limit	3
Degrade limit	4
Survivors percent	20
Redundancy factor	1
Crossover	1
Mutation type	1
Selection type	1
Inversion type	1
Variables number	20
User defined int	0
Reals	
Crossover rate	1.0
Shuffle rate	0.2
Mutation rate	0.01

Inversion rate	0.05
Inversion shuffle	0.5
Kick distribution	0.2
Exit value	7.05
Exit tolerance	0.05
Min value	0.0
Max value	3.0
Step value	0.1
Default value	1.0
User defined real	0.0

Table (3) parameters of input file

Strings	
Map file name	Steinerby file.gmp
Def file name	None
Input string #1	None
Input string # 2	None
User expression	None
User defined string	None
Flags	
Status help	True
Text window	True
Graphic window	True
Sound	True
Logging	True
User defined flag	False

Computer output result :

Screen output which gives simultaneous result with two separate screen, textual and graphical . first gives text results, and the second gives gives graphical result as shown in fig (2) , fig (3) and fig (4) . text window gives best point and total weighted connection length, while graphic window gives the current point, current generation, function calls and best point value.

Fig (2) computer output result of screen with first trial

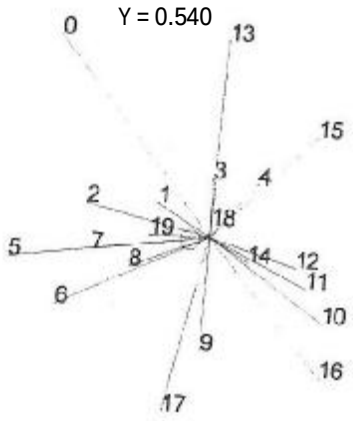
Text window (Toggle)	Graphic window (Toggle)
#0 curent: GEGIEHIGEEDEEEEEEGNJ:7.848 #1 curent: GEGIEHIGEEDEEEEEEGNJ:7.848 #2 curent: GEGIEHIGEEDEEEEEEGNJ:7.846 #3 curent: GEGIEHIGEEDEEEEEEGNJ:7.848 #4 curent: GEGIEEIGEEDEEEEEEGNJ:7.797 #5 curent: FEEIHEHGEIGEEEEEEGNJ:7.769 #6 curent: FEEIHEHGEIGEEEEEEGNJ:7.769 #7 curent: FEEEEEEEGEIGHEHIEGNJ:7.756 #8 curent: FEEIHEHGEFDEEEEEEFAJ:7.425 #9 curent: GEGIEEHGEFDEEEEEEFAJ:7.371 #10 curent: GEGIEEHGEFDEEEEEEFAJ:7.371 #11 curent: GEGEEEIGEFDEEEEEEFAJ:7.367 #12 curent: GEGIEEHEDFEGEEEEEFAJ:7.371 #13 curent: GEGGEGIGEFDEEEEEEFAJ:7.235 #14 curent: GEGGEGIGEFDEEEEEEFAJ:7.235 #15 curent: GEGGEGIGEFDEEEEEEFAJ:7.235 #16 curent: FEGIHEIGFGHEHEEEEFGJ:7.235 Solution: < FEGIHEIGFGHEHEEEEFGJ> R total weighted connections Length: 6.796	Current point : X= 0.590 Y = 0.540  Current generation : 16 Function calls : 1362
Test chromosome input box	Test chromosome value
Best chromosome : FEGIHEIGFGHEHEEEEFGJ	Best chromosome value : 6.795575954738891

Fig (3) computer output result of screen with second trial

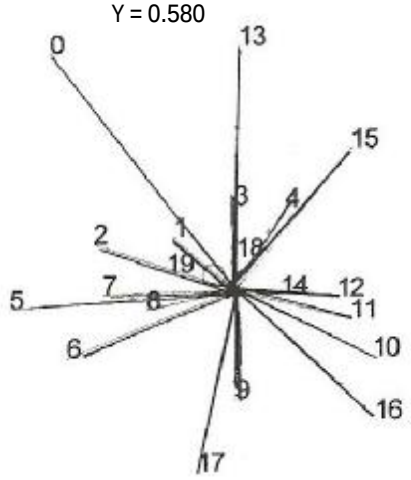
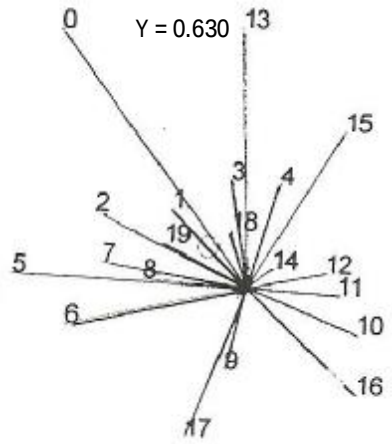
Text window (Toggle)	Graphic window (Toggle)
#17 curent: HGHGIEGGCLIHGIIGHHBB:8.116 #18 curent: HGHGIEGGCLIHQIIGGEBB:8.076 #19 curent: HGGGIEGGCLIHGIIGHHBB:8.073 #20 curent: HGGGIEGGCLIHGIIGGEBB:8.033 #21 curent: HGHGGHGGCLIHGIIGGEBB:7.898 #22 curent: HGHGIEGGCLIGGIGGGEBB:7.804 #23 curent: HGHGGHGGCUIGGIGHGHBB:7.804 #24 curent: HGHGGHGGCUIGGIGHGHBB:7.804 #25 curent: GHGGHGGCCGGHGIGHGHBB:7.275 #26 curent: GHGGHGGCCGGHGIGHGHBB:7.275 #27 curent: HGHGGGHGCCGGHGGHGHBB:7.260 #28 curent: HGGGGHGGCCGGHGGHGHBB:7.232 #29 curent: HGGGGHGGCCGGHGGHGHBB:7.232 #30 curent: HGHGGGHGCCGGHGHGGGBB:7.189 #31 curent: HGHGGGHGCCGGHGHGGGBB:7.189 #32 curent: HGHGGGHGCCGGHGHGGGBB:7.189 #33 curent: HGHGGGHGGGHGGHGHGHBB:6.794 Solution: < HGHGGGHGGGHGGHGHGHBB > R total weighted connections Length: 6.794	Current point : X= 0.590 Y = 0.580  Current generation : 33 Function calls : 1242
Test chromosome input box	Test chromosome value
Best chromosome : HGHGGGHGGGHGGHGHGHBB	Best chromosome value : 6.794471104441475

Fig (4) computer output result from screen with latest trial

Text window (Toggle)	Graphic window (Toggle)
#34 curent: GEGNGFHFGGHFGNGIHGHF: 8.079 #35 curent: GEGNGFHFGGHFGNGIHGHF: 8.079 #36 curent: GCGNGFHFGGHFGKGIHGHI: 7.923 #37 curent: GCGNGFHFGGHFGKGIHGHI: 7.923 #38 curent: GEGNGFGFGGHFGKGIHGHI: 7.617 #39 curent: GEGNGFGFGGHFGNGIHGHI: 7.617 #40 curent: GEGNGFGFGGHFGNGIHGHI: 7.617 #41 curent: GEGNGFGFGGCFGFGIHGHI: 7.392 #42 curent: GEGNGFGFGGCFGFGIHGHI: 7.392 #43 curent: GEGNGFGFGGCFGFGIHGHI: 7.392 #44 curent: GIGNGFGFGGHFGFGIHGHI: 7.257 #45 curent: GEGNGFHFGGHFGFGIHGHI: 7.219 #46 curent: GEGNGFGFGGHFGFGIHGHI: 7.164 #47 curent: GEGNGFGFGGHFGFGIHGHI: 7.164 #48 curent: GEGNGFGFGGHFGFGIHGHI: 7.164 #49 curent: GEGNGFGFGGGFGFGIHGHI: 7,110 #50 curent: GEGGGKGFHGGFGFGIHGHI: 6.605 Solution: < GEGGGKGFHGGFGFGIHGHI > R total weighted connections Length: 6.605	Current point : X= 0.630  Current generation : 50 Function calls : 982
Test chromosome input box	Test chromosome value
Best chromosome : GEGGGKGFHGGFGFGIHGHI	Best chromosome value : 6.6058239439756985

Chromosomes population for baghdad city:

The following table shows twenty points population which can be considered as suitable solutions for determing the problems in design.

Table (4) Baghdad first current population

Current population (with calculated (V) and fitness (F) value)		
GEGGGKGFHGGFGFGIHGHI	V: 6.606	F: 1.441
GEGNGFGFGGGFGFGIHGHI	V: 7.110	F: 0.970
GEGNGFGFGGGFGFGIHGHI	V: 7.110	F: 0.970
GEGNGFGFGGGFHFGIHGHI	V: 7.165	F: 0.919
GEGNGFGFGGHFGFGIHGHI	V: 7.165	F: 0.919
GEGNGFGFGGHFGFGIHGHI	V: 7.165	F: 0.919
GEGNGFGFGGHFGFGIHGHI	V: 7.165	F: 0.746
GEGNGFGFGGGFHFGIHGHI	V: 7.165	F: 0.746
GEGNGFGFGGHFGFGIHGHI	V: 7.165	F: 0.607
GEGNGFGFGGHFGFGIHGHI	V: 7.165	F: 0.496
GEGNGFGFGGGFGFGIHGHI	V: 7.165	F: 0.408
GEGNGFHFGGGFGFGIHGHI	V: 7.220	F: 0.868
GEGNGFHFGGGFGFGIHGHI	V: 7.220	F: 0.705
GEGNGFHFGGGFGFGIHGHI	V: 7.220	F: 0.574
GHIGFGFGGGFHFGNGEGHI	V: 7.220	F: 0.867
GHIGFGFGGGFHFGNGEGHI	V: 7.220	F: 0.704
GIGNGFGFGGHFGFGIHGHI	V: 7.258	F: 0.832
GEGNGFHFGGHFHFGIHGHI	V: 7.274	F: 0.817
GEGNGFGFGGHCGGFHFGHI	V: 7.331	F: 0.763
GEGNGFHFGGHFGFGJHGHI	V: 7.356	F: 0.740

Table (5) Baghdad cjty second current population

Current population (with calculated (V) and fitness (F) value)		
FEGIHEIGFGHEHEEEEFGJ	V: 6.796	F: 1.743
GEGEEEHEDFEGEHEEGFAJ	V: 7.211	F:1.130
GEGGEEHEDFEGEEEEEFAJ	V: 7.214	F:1.126
GEGGEGIGEFDEEEEEEFAJ	V: 7.235	F:1.095
GEGGEGIGEFDEEEEEEFAJ	V: 7.235	F:1.095
GEGEEEDFEGHEHEEEEFAJ	V: 7.267	F:1.049
GEGEEEDFEGHEHEEEEFAJ	V: 7.267	F:1.049
GEGEEEHEDFEGEEEEEFAJ	V: 7.272	F:1.041
GEGEEEHEDFEGEEEEEFAJ	V: 7.272	F: 1.041
FEGIHEIGFGHEHEEEEFAJ	V: 7.311	F: 0.983
GEGIEEHEDFEGEEEEEFAJ	V: 7.365	F: 0.903
GEGIEEHEDFEGEEEEEFAJ	V: 7.365	F: 0.631
FEGIEEHEDFEGEEEEEFAJ	V: 7.370	F: 0.896
FEGIEEHEDFEGEEEEEFAJ	V: 7.379	F: 0.883
GEIEGGIGHFDEEEEEEFAJ	V: 7.409	F: 0.838
FEGIHEIGFFDEEEEEEFAJ	V: 7.411	F: 0.836
FEGIEEHFDHEEEEEEEFAJ	V: 7.436	F: 0.799
FEGIHEEEEFDEEEEEEFAJ	V: 7.442	F: 0.790
GEIEEGIGEFDEEEEEEFAJ	V: 7.443	F: 0.789
FEGIEEHEDFDEEEEEEFAJ	V: 7.536	F: 0.652

Table (6) best generation population and best chromosoms.

Current population (with calculated (V) and fitness (F) value)		
HGHGGGHGGGHGGHGHGHBB	V: 6.794	F: 1.294
HGGGGHGGCGHGGHGHGHBB	V: 7.035	F: 1.003
HGHGGGHGCCGGHGHGGGBB	V: 7.189	F: 0.816
HGHGGGHGCCGGHGHGGGBB	V: 7.189	F: 0.816
HGGGGHGGCCGFHGGHGHBB	V: 7.229	F: 0.769
HGGGGHGGCCGFHGGHGHBB	V: 7.229	F: 0.769
HGGGGHGGCCGFHGGHGHBB	V: 7.229	F: 0.769
HGGGGHGGCCGFHGGHGHBB	V: 7.229	F: 0.585
HGGGGHGGCCGGHGGHGHBB	V: 7.232	F: 0.765
HGGGGHGGCCGGHGGHGHBB	V: 7.232	F: 0.765
HGGGGHGGCCGGHGGHGHBB	V: 7.232	F: 0.582
HGGGGHHFGHFGCCGGGHBB	V: 7.239	F: 0.757
HGHGGGHGCCGFHGGHGHBB	V: 7.257	F: 0.735
HGHGGGHGCCGFHGGHGHBB	V: 7.257	F: 0.558
HGHGGGHGCCGFHGGHGHBB	V: 7.257	F: 0.416
HGHGGGHGCCGGHGGHGHBB	V: 7.261	F: 0.730
HGHGGGHGCCGGHGGHGHBB	V: 7.261	F: 0.554
HGHGGGHGCCGGHGGHGHBB	V: 7.261	F: 0.413
HGHGGGHGCCGGHGFHGHBB	V: 7.263	F: 0.728
HGHGGGHGCCGGHGFHGHBB	V: 7.263	F: 0.552

Discussion about the calculation and simulation results for Baghdad city:

- **firstly to give a good result the refrences map must be updated with complete details to get dependable base to optimize the problem .**

- **secondly the diminsion of the problem may not be the coordinate of the important sector, the diminution of the problem may be the population density or size of power demand or any other required dimension.**

- **from the results , the GAs has reached the optimum position with allowed number of itterations and this is one of the advantages of genetic algorithms GAs.**

- **The best chromosome was (GEGGGKGFHGGFGFGIHGHI) and its value (6.6058239439756985).**

- **The optimul position is at x = 0.630 , y = 0.630**

- **As for the previous calculation , the same procedure will be followed for Basrah and Mousel cities since we have same problems.**

Optimization Problems for Iraqi Governorates (Cities).

Iraqi optimization problem differs from big Iraqi cities (fig 5) problem. Previous problem was how to find optimum point (optimum position) which gives shortest connection length between this point and roughly distributed points (sectors or small cities). The current problem is how to connect the governorates of Iraq with shortest transmission lines without intersection point i.e. passing one time for each city.

The similarity between two problems is using the genetic algorithms but the difference is, GAs optimization problem was Steiner problem .The current optimization problem is Travlling Salesman Problem (TSP) which is different in input file and output results.

Fig (5) Iraq cities

Calculation and Computer Simulation Results.

- **Table (7) represents the basic input data required to the input file for GAs playground.**
- **The input file is read from computer as update, roughly chosen chromosome. This chromosome is simulated in GAs playground programmed computer.**
- **Figures (6, 7, 8, and 9) represent good, better-and best solutions respectively. These screen output results gives:**

1. **Textual current chromosomes.**
2. **Minimum total length.**
3. **Best chromosome and best chromosome value.**
4. **Current generation, current point, function calls.**

- **A Tables (8, 9, and 10) give results for latest twenty current populations**

with fitness and value for each chromosome. The best chromosome situation is at the top of each table. The optimized coordinates of Baghdad, Basra, Mousel have been taken from previous problem optimization which are:

1. **Basra governorate optimal. Point (x=0.740, y=0.530).**
2. **Baghdad governorate optimal point (x=0.630, y=0.630).**
3. **Mosul governorate optimal point (x=0.540, y=0.610).**

Table (7) Genetic In out Coded Data for Iraqi Important Cities

530City Number in Graphic Screen	City Genetic Cod	Name of City	(x, y) Coordinates	Normalized (x, y) coordinates
City NO : 0	A	BASRAH	2269.2212	0.740,0.530
City NO : 1	B	AN-NASRAH	1901.2079	0.726,0.685
City NO : 2	C	AS SAMAWAH	1670.2016	0.638,0.603
City NO : 3	D	ANNAJAF	1447.1830	0.553,0.603
City NO : 4	E	ADDIWANIYAH	1580.1830	0.603,0.603
City NO : 5	F	ALAMARAH	2105.1857	0.804,0.612
City NO : 6	G	ALKUT	1788.1676	0.683,0.552
City NO : 7	H	ALHILLAH	1470.1694	0.562,0.558
City NO : 8	I	KARBALA	1372.1663	0.524,0.548
City NO : 9	J	BAGHDAD	1460.1460	0.630,0.630
City NO : 10	K	BAGUBAH	1515.1348	0.579,0.445
City NO : 11	L	ARRAMADI	1210.1437	0.462,0.474
City NO : 12	M	SALAH ADDIN	1300.1124	0.496,0.370
City NO : 13	N	ASSULAYMANIYAH	1690.850	0.646,0.280
City NO : 14	O	KIRKUK	1457.879	0.557,0.290
City NO : 15	P	ARBIL	1372.685	0.524,0.226
City NO : 16	Q	MOSUL	1180.643	0.540,0.610
City NO : 17	R	DIHOK	1150.500	0.439,0.165
City NO : 18	S	SAMARA	1341.1232	0.512,0.406
City NO : 19	T	DRBANDIKHAN	1477.975	0.553,0.321

Table (8) First Current Population for iraq

Current Population (with calculated (V) and fitness (F) values)		
LMJFKIEGSHNQPORTCBAD	V: 3.453	F: 1.635
LMJFEDKIGCHNQPORTSBA	V: 4.049	F: 1.272
LMJKIGCEQNHFPORTSBAD	V: 4.544	F: 0.971
LMJKIGCEQNHFPORTSBAD	V: 4.544	F: 0.971
LMJKIGCONQHFEPRTSBAD	V: 4.552	F: 0.967
LMJKIGCONQHFEPRTSBAD	V: 4.552	F: 0.967
LMJKIGCONQHFEPRTSBAD	V: 4.552	F: 0.844
LMJKIGCONQHFEPRTSBAD	V: 4.552	F: 0.844
LMJKIGCONQHFEPRTSBAD	V: 4.552	F: 0.747
LMJKIGCONQHFEPRTSBAD	V: 4.552	F: 0.668
LMJFEDHQKIGCNPORTSBA	V: 4.605	F: 0.934
LMJFEDHQKIGCNPORTSBA	V: 4.605	F: 0.934
LMEKIGCNQHFJPORTSBAD	V: 4.642	F: 0.912
LMJFKIGCONQHEPRTSBAD	V: 4.663	F: 0.899
LMJFKIGCONQHEPRTSBAD	V: 4.663	F: 0.790
LMJFKIGCONQHEPRTSBAD	V: 4.663	F: 0.704
MEKIGCHNQLFJPORTSBAD	V: 4.705	F: 0.874
MEKIGCHNQLFJOPRTSBAD	V: 4.719	F: 0.865
OPFQNHCGIKEJMLRTSBAD	V: 4.977	F: 0.708
LMEKIGCNQHFJDPORTSBA	V: 5.051	F: 0.663

Table (9) Second Current Population for Iraq.

Current Population (with calculated (V) and fitness (F) values)		
ADBFGIKOCEJHMLTRNPQS	V: 3.373	F: 1.397
ABDFKGIOCEJHMLTRNPQS	V: 3.834	F: 1.012
ADBFGIKJQTNROLCEHMPS	V: 3.963	F: 1.904
ABFGIKJHMCLORNTQPSED	V: 3.965	F: 1.903
ABFGIKDOCEJHMLTRNPQS	V: 3.979	F: 0.891
ABFGIKDOCEJHMLTRNPQS	V: 3.979	F: 0.891
ABFGIKDOCEJHMLTRNPQS	V: 3.979	F: 0.738
ADFKBGIOCEJHMLTRNPQS	V: 4.048	F: 0.833
ADFKJHMGICLORNTQPSEB	V: 4.064	F: 0.820
ADFKJHMGICLORNTQPSEB	V: 4.064	F: 0.571
ADFKJHMGICLORNTQPSEB	V: 4.064	F: 0.682
ABFGIKDOCEJHMLTRPNQS	V: 4.077	F: 0.809
ABFGIKDOCEJHMLTRPNQS	V: 4.077	F: 0.673
ABFGIKDOCEJHMLTRPNQS	V: 4.077	F: 0.564
ABFGIKDOCEJHMLTRPNQS	V: 4.077	F: 0.477
ABFGIKJQTNROLDCEHMPS	V: 4.125	F: 0.769
ADFKJHMGICLORNTQPSBE	V: 4.146	F: 0.752
ADFKJHMGICLORNTQPSBE	V: 4.146	F: 0.627
ABFIGKDOCEJHMLTRPNQS	V: 4.200	F: 0.706
ADFKJHMGICBOELTRNPQS	V: 4.448	F: 0.499

Table (10) thrid Current Population for Iraq.

Current Population (with calculated (V) and fitness (F) values)		
QPORNMLTCDABHJKSIEFG	V: 3.079	F: 2.033
QPKRNTMLCDABHJOSIFEG	V: 3.840	F: 1.315
QPKRNTMLCDABHJOSIEFG	V: 3.856	F: 1.299
QPKRNMLTCDABHJSIFEGO	V: 3.929	F: 1.231
QPKRNMLTCDABHJSIFEGO	V: 3.929	F: 1.231
QPKRNMLTCDABHJSIFEGO	V: 3.929	F: 1.997
QPKRNMLTCDABHJOSIFEG	V: 3.957	F: 1.204
QPKRNMLTCDABHJOSIFEG	V: 3.957	F: 1.204
QPKRNMLTCDABHJOSIFEG	V: 3.957	F: 0.976
QPKRNTHSLCDABJOMIFEG	V: 3.965	F: 1.196
QPKRNMLTCDABHJOSIEFG	V: 3.973	F: 1.189
QPKRNTHSMLCDABJOIFEG	V: 3.982	F: 1.180
QPKRNLMTCDABHJOSIFEG	V: 3.995	F: 1.168
QPKRNTHSMLCDABJOIEFG	V: 3.999	F: 1.165
QPKRNTHSMLCDABJOIEFG	V: 3.999	F: 0.944
QPKRNMLTFISOJHBADCEG	V: 3.999	F: 1.165
QPKRNMLTCDABHSJOIFEG	V: 4.16	F: 1.016
BADCLSHTNRKPQJOMIEFG	V: 4.387	F: 0.798
QPERNMLTCDABHJOSIKFG	V: 4.408	F: 0.778
CTLMNRKPQDABHJOSIFEG	V: 4.696	F: 0.506

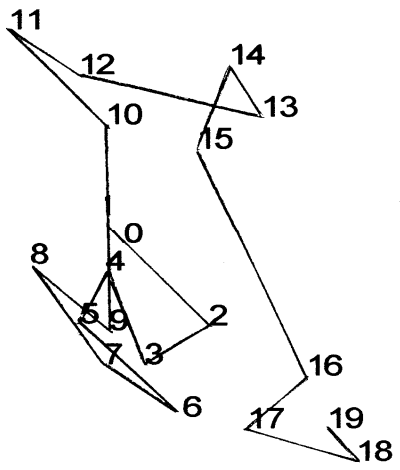
Text window(toggle)	Graphic window(toggle)
Tsp Demo(Input from file)-Solution Chromosome:< LMJFKIEGSHNOPORTOBAD> Length of tour: 3.453 Point# 000 City number.011 - x: 0.665 y: 0.600 Point# 001 City number.012 - x: 0.628 y: 0.549 Point# 002 City number.009 - x: 0.785 y: 0.747 Point# 003 City number.005 - x: 0 .695 y: 0.814 Point# 004 City number.010 - x: 0.641 y: 0.650 Point# 005 City number.008 - x: 0.604 y: 0.741 Point# 006 City number.004 - x: 0.748 y: 0.904 Point# 007 City number.006 - x: 0.636 y: 0.814 Point# 008 City number.018 - x: 0.530 y: 0.637 Point# 009 City number.007 - x: 0.645 y: 0.755 Point# 010 City number.013 - x: 0.640 y: 0.392 Point# 011 City number.016 - x: 0.504 y: 0.223 Point# 012 City number.015 - x: 0.603 y: 0.305 Point# 013 City number.014 - x: 0.860 y: 0.378 Point# 014 City number.017 - x: 0.818 y: 0.287 Point# 015 City number.019 - x: 0.768 y: 0.434 Point# 016 City number.002 - x: 0.925 y: 0.835 Point# 017 City number.001 - x: 0.843 y: 0.927	Current Best :3.453 Current Generation: 11 Function Calles:242 
Test Chromosome Input Box	Test Chromosome Value
Best Chromosome: LMJFKIEGSHNOPORTOBAD	Best Chromosome Value: 3.4530954271914176

Fig: (6) First Trial, Length of Tour 3.453 Best Chromosome (LMJFKIEGSHNOPORTOBAD).

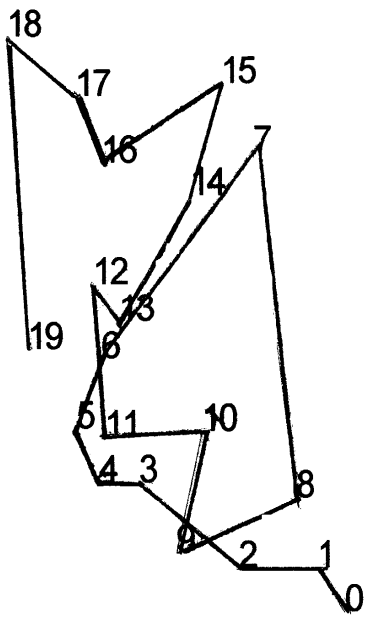
Text window(toggle)	Graphic window(toggle)
TspDemo(inpute frome file)-Solution Chromosome:< ADBFGIKOCEJHMLTRNPQS> Length of tour: 3.373 Point# 000 City number.000 - x :.966 y: .986 Point# 001 City number.003 - x: .953 y: .927 Point# 002 City number.001 - x: .843 y: .927 Point# 003 City number.005 - x: .695 y: .814 Point# 004 City number.006 - x: .636 y: .814 Point# 005 City number.008 - x: .604 y: .741 Point# 006 City number.010 - x: .641 y: .650 Point# 007 City number 041 - x: .860 y: .378 Point# 008 City number 002 - x: .925 y: .835 Point# 009 City number 004 x: .748 y: .904 Point# 010 City number.009 - x: .785 y: .747 Point# 011 City number.007 - x: .645 y: .755 Point# 012 City number.012 - x: .628 y: .549 Point# 013 City number.011 - x: .665 y: .600 Point# 014 City number 019 - x: .768 y: .434 Point# 015 City number.017 - x: .818 y: .287 Point# 016 City number.013 - x: .640 y: .392 Point# 017 City number.015 - x: .603 y: .305 Point# 018 City number.016 - x: .504 y: .223 Point# 019 City number.018 - x: .530 y: .637	Current Best :3.373 Current Generation: 19 Function Calles:422 
Test Chromosome Input Box	Test Chromosome Value
Best Chromosome: ADBFGIKOCEJHMLTRNPQS	Best Chromosome Value: .373367866528481

Fig (7) Second Trial, Length of Tour 3.373 Best Chromosome (ADBFGIKOCEJHMLTRNPQS).

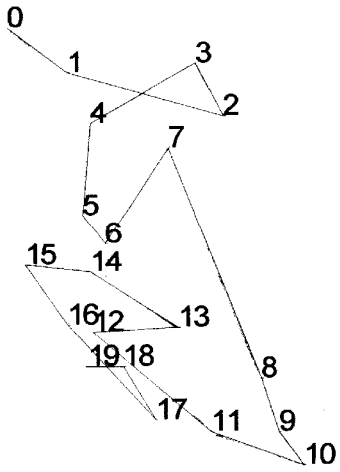
Text window(toggle)	Graphic window(toggle)
Tsp Demo(Input from file)-Solution Chromosome:< QPORNMLTODABHJKSIEFG > Length of tour: 3.079 Point# 000 City number.016 - x: 0.504 y: 0.223 Point# 001 City number.015 - x: 0.603 y: 0.305 Point# 002 City number.014 - x: 0.860 y: 0.378 Point# 003 City number.017 - x: 0 .818 y: 0.287 Point# 004 City number.013 - x: 0.640 y: 0.392 Point# 005 City number.012 - x: 0.628 y: 0.549 Point# 006 City number.011 - x: 0.665 y: 0.600 Point# 007 City number.019 - x: 0.768 y: 0.434 Point# 008 City number.002 - x: 0.925 y: 0.835 Point# 009 City number.003 - x: 0.953 y: 0.927 Point# 010 City number.000 - x: 0.966 y: 0.986 Point# 011 City number.001 - x: 0.843 y: 0.927 Point# 012 City number.007 - x: 0.645 y: 0.755 Point# 013 City number.009 - x: 0.785 y: 0.747 Point# 014 City number.010 - x: 0.641 y: 0.650 Point# 015 City number.018 - x: 0.530 y: 0.637 Point# 016 City number.008 - x: 0.604 y: 0.741 Point# 017 City number.004 - x: 0.748 y: 0.904 Point# 018 City number.005 - x: 0.695 y: 0.814 Point# 019 City number.006 - x: 0.636 y: 0.814	Current Best :3.079 Current Generation: 19 Function Calles:402 
Test Chromosome Input Box	Test Chromosome Value
Best Chromosome: QPORNMLTODABHJKSIEFG	Best Chromosome Value: 3.07986894494224413

Fig (8) third trail , length of tour 3.079 best chromosom

(QPORNMLTODABHJKSIEFG)

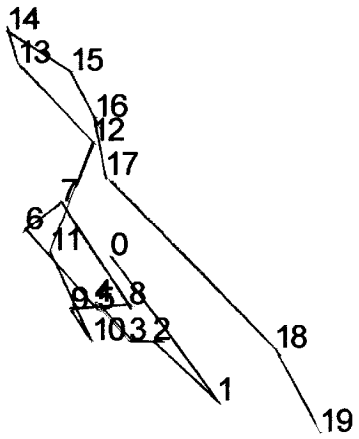
Text window(toggle)	Graphic window(toggle)
Tsp Demo(Input from file)-Solution Chromosome:<KBCEJHLSGIDMTQRPONFA > Length of tour: 2.574 Point# 000 City number.010 - x: 0.665 y: 0.553 Point# 001 City number.001 - x: 0.834 y: 0.787 Point# 002 City number.002 - x: 0.733 y: 0.693 Point# 003 City number.004 - x: 0 .693 y: 0.693 Point# 004 City number.009 - x: 0.642 y: 0.630 Point# 005 City number.007 - x: 0.646 y: 0.641 Point# 006 City number.011 - x: 0.531 y: 0.511 Point# 007 City number.018 - x: 0.588 y: 0.466 Point# 008 City number.006 - x: 0.693 y: 0.635 Point# 009 City number.008 - x: 0.602 y: 0.641 Point# 010 City number.003 - x: 0.636 y: 0.693 Point# 011 City number.012 - x: 0.570 y: 0.545 Point# 012 City number.019 - x: 0.363 y: 0.369 Point# 013 City number.016 - x: 0.518 y: 0.243 Point# 014 City number.017 - x: 0.504 y: 0.189 Point# 015 City number.015 - x: 0.602 y: 0.259 Point# 016 City number.014 - x: 0.640 y: 0.333 Point# 017 City number.013 - x: 0.656 y: 0.425 Point# 018 City number.005 - x: 0.924 y: 0.703 Point# 019 City number.000 - x: 0.997 y: 0.839	Current Best :2.574 Current Generation: 3 Function Calles:582 
Test Chromosome Input Box	Test Chromosome Value
Best Chromosome: KBCEJHLSGIDMTQRPONFA	Best Chromosome Value: 2.573786466515322

Fig (9) Latest Trial, Length of Tour 2.573 Best Chromosome (KBCEJHLSGIDMTQRPONFA).

Conclusion :

The genetic algorithm is very simple, yet it performs well on many different types of problems. But there are many ways to modify the basic algorithm, and many parameters that can be 'tweaked'. Basically, if you get the objective function right, the representation right and the operators right, then variations on the genetic algorithm and its parameters will result in only minor improvements. Since the algorithm is separated from the representation, searches of mixed continuous/discrete variables are just as easy as searches of entirely discrete or entirely continuous variables . From the Results, the best chromosome must have minimum value, so that the last iteration list the first chromosome which represents the optimum solution with minimum connection line, minimum length of tour (shortest transmission line) means minimum losses, minimum cost per km. So this optimization can be applied to connect all electrical power stations, shortest high voltage transmissions line, ring Feeder as an example. But this optimization can be applied to any application having the same optimization problems.

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اختيار اقصر وافضل الطرق للربط بين المدن العراقية باستخدام الخوارزميات المتطورة

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المستخلص :

يعتبر genetic algorithem من التقنيات الحديثة لايجاد افضل الحلول من ضمن مجموعة حلول لكل لنواع المشاكل الهندسية ولكافة الاختصاصات (الكترونيك – قدرة كهربائية – الاتصالات - ..... الخ) وهذه الحلول يمكن استخراجها باقل عدد من المحاولات الحسابية . هذه التقنية الموضحة بالبحث تستخدم لعدة تطبيقات مثل اختيار موقع لانشاء محطة كهرباء او موقع لبناء مركز اتصالات حيث يستفاد من هذا البحث لتقليل الكلفة اللازمة لكل وحدة طول (price / Km) لخطوط النقل . هذه التقنية نفذت باستخدام تقنية Gas play ground مع ادخالات مناسبة للمواقع المحددة في الخارطة.