

استخدام الخوارزمية الجينية في حل مسألة صفوف الانتظار

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Using Genetic Algorithm for Solving Queuing Problem

Abstract

In this research, genetic algorithm is used to solve Queuing problem, which is considered to be of special importance as a result of the costs emanating from waiting and operating, is suggested. The problem aims at locating the period of time for waiting on the distant range and making this period of time as less as possible. The application of this genetic algorithm to this problem led to limiting the most ideal number of the people served and making the total cost concerning the party who offers the service as less as possible during the period of time specified for waiting.

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تاريخ التسلم: 2006/ 2/ 28 — تاريخ القبول : 2007/ 12/17

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Introduction

-1

1909

Erlang

1928

Thornton

1927

Molins

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[3]. (...

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:(Customer) (1)

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:(Queue) (2)

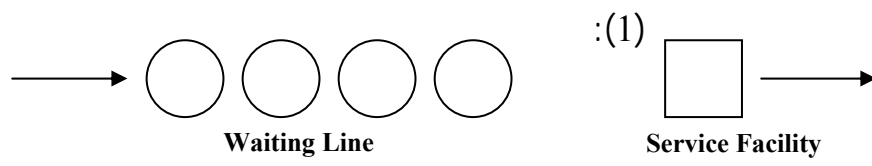
- :(Service Channel) (3)
- :(Calling Source) (4)
- :(System Capacity) (5)
- :(Service discipline) (6)
- :
- (First Come- First Served) -
- (Last Come- First Served) -
- (Service in Random order) -
- (Service on Priority) -

[5] .

[2] .

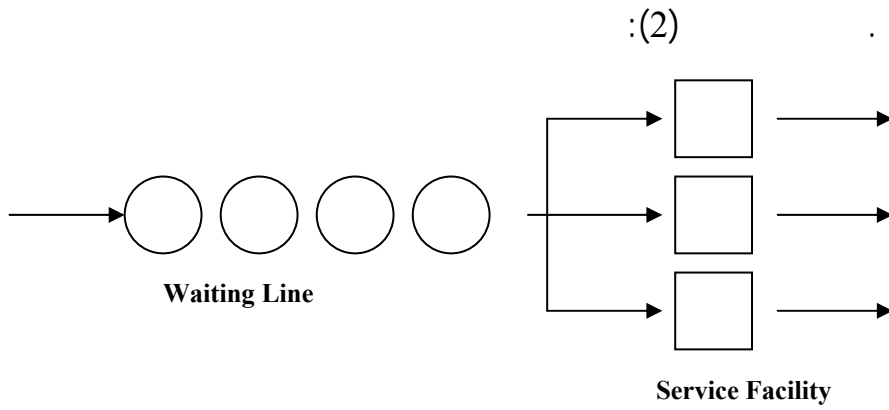
[4] : (Systems of Queuing) .2

:
: 2.1



(1)

: 2.2

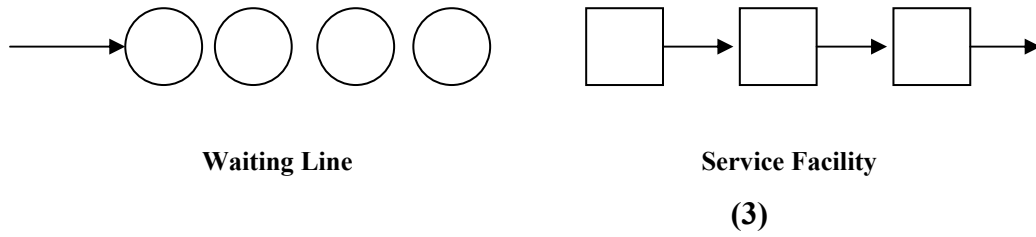


(2)

:

2.3

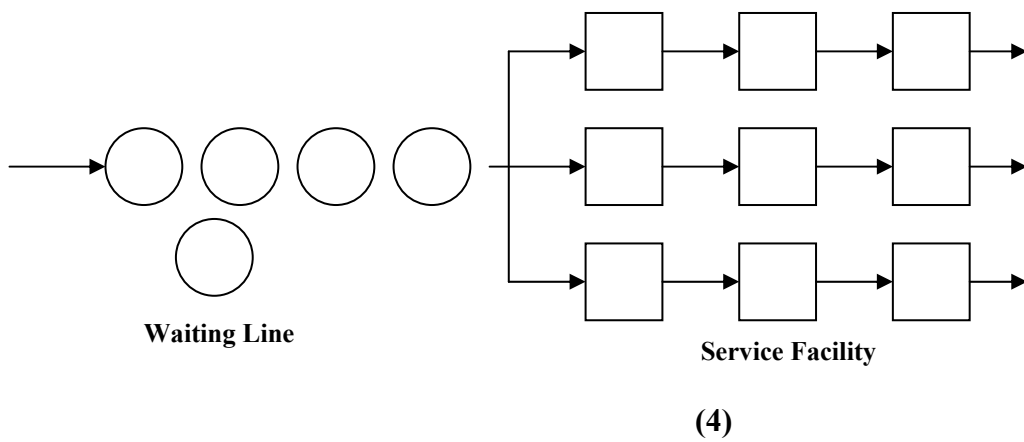
(3)



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2.4

(4)



...

(Kendall)

.(/)

()

:

:M

:D

(Erlang-k)

:E_k

:G₁

:G

(G₁/E3/C/10/10/LCFS)

C

Erlang-3

)

10

10

[2] .(

3. الخوارزمية الجينية (Genetic Algorithm):

(GA)

)

(

1970

(John Holland)

[7]

(John Koza) 1992

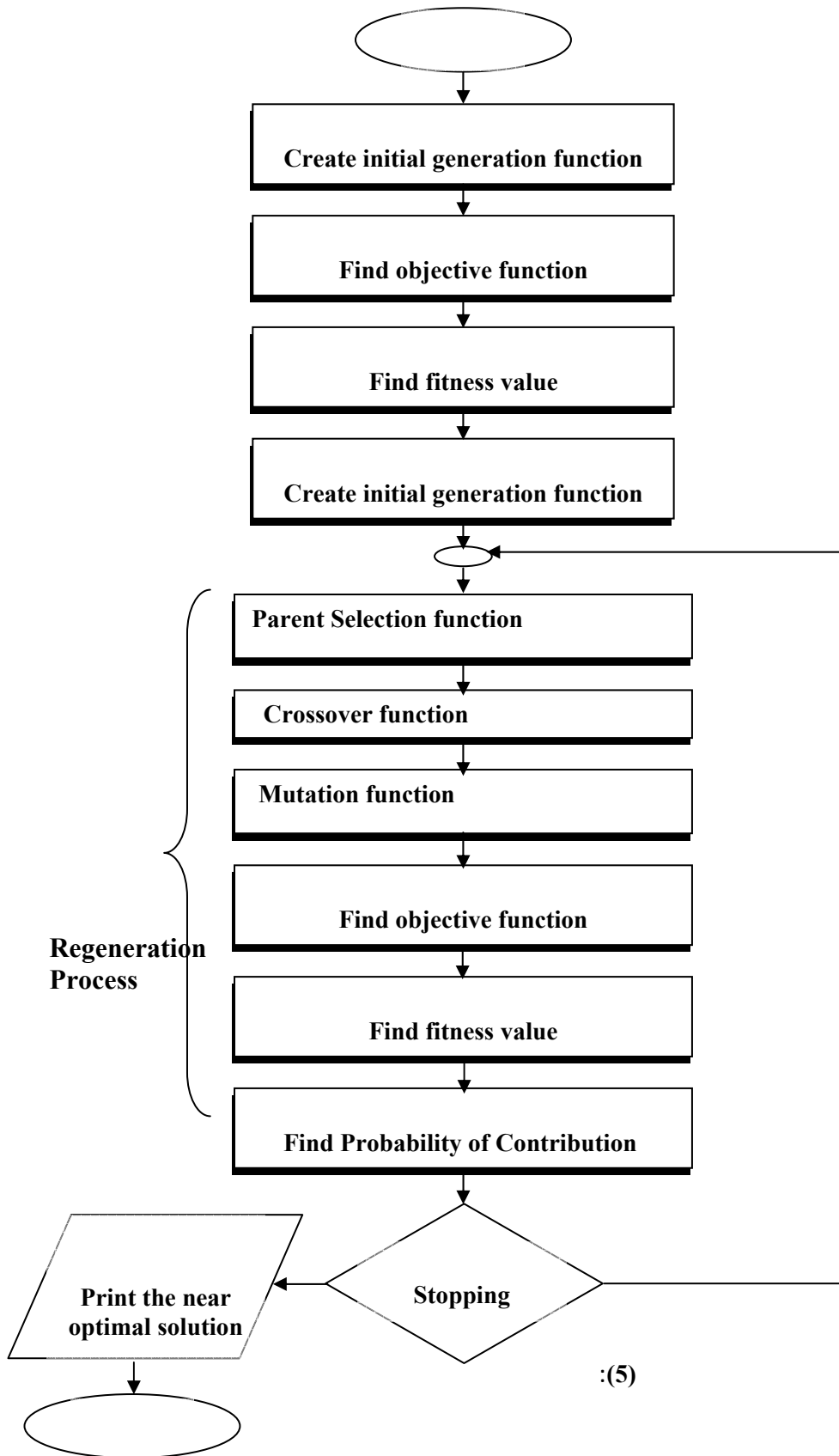
(Genetic)

[8] .(G.P) Programming

[7] .

4. المخطط العام للخوارزمية الجينية (General Diagram of the GA):

[1] . (5)



.5

(Finding the Solutions for the QP by using GA)

.6

(The Proposed steps to use GA in QP)

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:(Initial Data) .1

:

:(AT) (Arrival Time) •

:(ST) (Service Time) •

• :TM

...

:nC •

:nS •

:C cost •

:S cost •

:(Initial Generation)

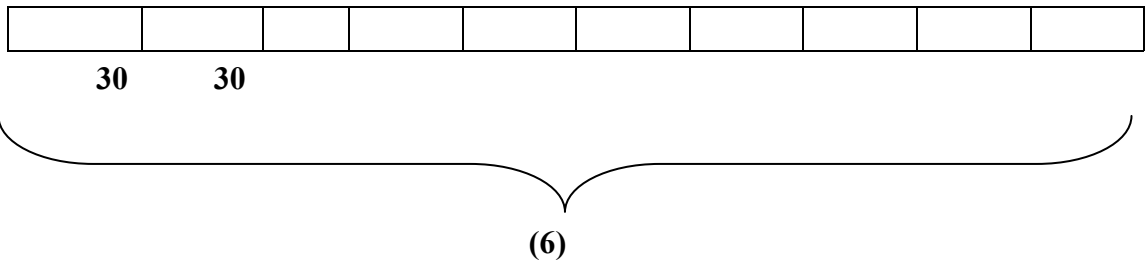
.2

(5)

(30)

: (6)

(10)



(30)

(1,0)

.(Binary Encoding)

:

:(Fitness Value)

.3

$$Z = Z + (STG * TM - SE(K))$$

:

: Z

: STG

: TM

: SE

: K

)

(Toolbox)

(

(MATLAB7)

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(

.[4]

.7

(The Application of the proposed steps of GA for solving QP):

[4] .

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...

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(1)

PW	DW	ET	BT	ST	AT	No.P
0	1	3	1	2	1	1
1	0	6	3	3	2	2
3	0	8	6	2	3	3
4	0	9	8	1	4	4
4	0	11	9	2	5	5
5	0	13	11	2	6	6
6.3	0	14	13	1	6.7	7
6.6	0	15	14	1	7.4	8
6.9	0	17	15	2	8.1	9
8.2	0	18	17	1	8.8	10
45	1					Sum

()

(2)

PW	DW ₂	DW ₁	ET ₂	BT ₂	ET ₁	BT ₁	ST	AT	No.P
0	-	1	-	-	3	1	2	1	1
0	2	-	5	2	-	-	3	2	2
0	-	0	-	-	5	3	2	3	3
1	0	-	6	5	-	-	1	4	4
0	-	0	-	-	7	5	2	5	5
0	0	-	8	6	-	-	2	6	6
0.3	-	0	-	-	8	7	1	6.7	7
0.6	0	-	9	8	-	-	1	7.4	8
0	-	0.1	-	-	10.1	8.1	2	8.1	9
0.2	0	-	10	9	-	-	1	8.8	10
2.1	<i>PpW</i>	3.1	DW					Sum	

() (3)

W P	WD 3	WD 2	WD 1	ET 3	BT 3	ET 2	BT 2	ET 1	BT 1	S T	AT	No.P
0	-	-	1	-	-	-	-	3	1	2	1	1
0	-	2	-	-	-	5	2	-	-	3	2	2
0	3	-	-	5	3	-	-	-	-	2	3	3
0	-	-	1	-	-	-	-	5	4	1	4	4
0	0	-	-	7	5	-	-	-	-	2	5	5
0	-	1	-	-	-	8	6	-	-	2	6	6
0	-	-	2.4	-	-	-	-	8.4	7.4	1	7.4	7
0	1.1	-	-	9.1	8.1	-	-	-	-	1	8.1	8
0	-	0.8	-	-	-	10. 8	8.8	-	-	2	8.8	9
0	-	-	1.1	-	-	-	-	10. 5	9.5	1	9.5	10
0	4.1	3.8	5.5									
0	PW	13.4	DW									Sum

: ST : AT : No. P :

: DW : ET : BT

: PW

(45 =PW)

(3.15 = 0.07 x 45) (0.07)

(DW=0)

...

()

(2.1)

(0.147=0.07x2.1)

.

()

13.4) (13.4=DW)

(10000)

(

(2.68=0.2x13.4) (0.2)

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)

(

() (20)

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0	1	0	1	1	0	1	1	0
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Gene9 Gene 8 Gene 7 Gene 6 Gene 5 Gene 4 Gene 3 Gene 2 Gene 1



Chromosome

(6)

:

16 19 28 30 8 18 28 34 28 :

26.5 27 34.5 45 14 20 51 55 42 :

(28)

(20)

)

(42)

(

()

(Fitness value)

)

(

.()

. (6) (5) (4)

...

: (4)

عدد مرات التوليد: 100

نوع التداخل الابدالي: Single point

نوع الطفرة: Gaussian

نوع الانتقاء: Stochastic uniform

عدد الأطباء: 4

عدد المرضى: 442

		()	
2	28	0110	94.668
3	28	101010	97.375
4	31	01100110	100.529
5	31	0110100010	89.624
6	57	011010000010	82.030
7	52	01101000001010	83.470
8	32	1010100000101010	84.976
9	60	011010000001011010	82.745
10	55	10011000000101010010	83.847
11	64	1010100000011001010010	66.834
12	86	101010000101100101001010	72.028
13	78	01101000000110010010100110	96.331
14	61	1001100000101010010010011110	79.296
15	71	011001100001100101001001110110	81.531
16	100	10011000001010010100100111100110	72.366

: (5)

عدد مرات التوليد: 150

نوع التداخل الابدالي: Two point

نوع الطفرة: Uniform

نوع الانتقاء: Roulette

عدد الأطباء: 4

عدد المرضى: 442

		()	
2	27	0110	94.668
3	32	101010	97.375
4	29	01101010	96.028
5	27	0111100010	101.455
6	34	011010000010	82.03
7	52	01101000000110	80.963
8	29	0111100000011010	92.795
9	34	011001010001101010	94.216
10	40	10101000000110010010	73.784
11	52	1001100000100101010010	74.924
12	76	101010000010011001001010	71.104
13	50	10101001001010100100110110	84.819
14	58	0110100000100110010001011110	69.726
15	65	101110000010011001000110011110	93.259
16	43	10101000001010010100010111100010	69.566

...

: (6)

عدد مرات التوليد: 250

نوع التداخل الابدالي: Single point

نوع الطفرة: Uniform

نوع الانتقاء: Roulette

عدد الأطباء: 4

عدد المرضى: 442

		()	
2	30	0110	94.668
3	27	011010	96.028
4	29	01101010	96.027
5	33	0110100110	95.276
6	35	011001010010	94.163
7	43	10101010001010	97.333
8	39	0110100000100110	80.443
9	51	011010100001100010	89.792
10	68	01101000000110010110	73.307
11	81	1001100000100110010010	79.023
12	33	011101010110100100010110	111.733
13	64	10101000001001010100101010	67.004
14	41	0110100000101001010001011110	67.963
15	49	101001100000101001001001101010	101.237
16	50	10101000000101100101011010100101	86.857

.8 :

المصادر References

أ- المصادر العربية:

.1 . (2004) :

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.2 . (1998) :

.3 . (1986) :

.4 . (2000) :

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.5 . (1991) :

ب - المصادر الأجنبية:

6. GEN, M. (2000): "Genetic Algorithms and Engineering Optimization", John Wiley and Sons, Inc.
7. Goldberg, D.E. (1989): "Genetic Algorithms in Search, Optimization and Machine Learning", Addison-Wesley.
8. Mitchell, M. (1998): "An Introduction to Genetic Algorithms", MIT Press London.