Caso 1

May 25, 2020

Hacemos las importaciones pertinentes y ajustamos el tamaño de las gráficas

[9]:
```
%run ../ajuste-parametrico.py

# %matplotlib notebook
plt.rcParams["figure.figsize"] = (15,9)
```

[10]:
```
plt.rcParams["figure.figsize"] = (15,9)
BASE_URL = "C:\\Users\\GL753V\\OneDrive - Universidad Politécnica de Madrid\\ů␣
 ↪TFM\\proyecto\\ajuste-parametrico\\primera-iteracion\\"
```

El orden de los parámetros ordenados por robustez es:

1. Tipo de VNS

   Para skewed:

   1.1. Alpha

   1.2. Función de distancia

2. Estructuras de vecindad y orden
3. Naturaleza del orden de los entornos (determinísticos o probabilísticos)

   Para Probabilístico:

   3.1. Probabilidad de diversificación

   3.2. Variación de la probabilidad de diversificación

   3.3. Numero de iteraciones sin variar la probabilidad de diversificación

4. Número de iteraciones para comprobar el porcentaje de mejoría (ciclos)
5. Porcentaje mínimo de mejoría
6. Número máximo de iteraciones sin mejora para la búsqueda local
7. Porcentaje mínimo de mejoría para la búsqueda local

1 Tipo de VNS

Empezamos el ajuste con el tipo de VNS. Para ello probamos diferentes valores para alpha y la funcion de distancia cuando ejecutemos el SVNS

1.1 Alpha y función de distancia

Para poder ajustar el alpha tenemos dos posibilidades, empleando como función de distancia el número de slots y empleando la diferencia del valor de los fitness

1.1.1 Funcion de distancia: Número de Slots

[12]:
```
base_path = BASE_URL + "1-TipoVNS\\SVNS\\slots"
sub_paths = get_subpaths(base_path, float)

parametro="SVNS Alpha slots"
out_path="1-1 "+parametro+"/"
```

[13]:
```
ajuste_parametrico(base_path, sub_paths, out_path, parametro)
```

```
['0.25', '0.5', '1.0', '1.25', '1.5', '2.0', '5.0', '10.0', '15.0', '20.0',
'30.0', '40.0', '50.0']
```

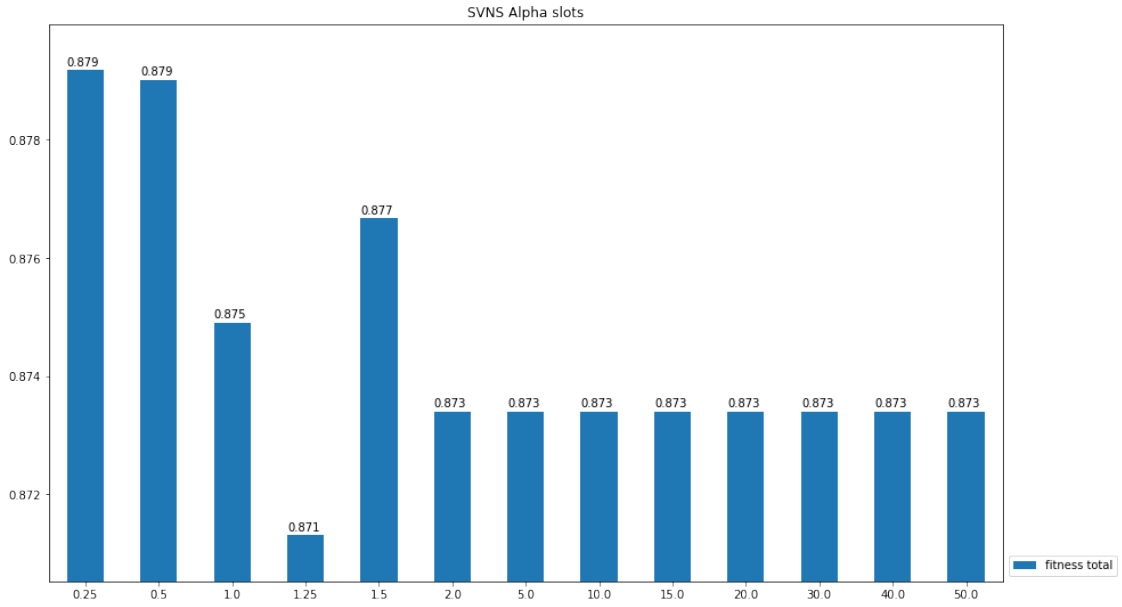
	iteracion	tiempo (ms)	fitness total	fitness 1	fitness 2	fitness 3	\
1.25	5001.0	82811.0	0.871307	1.0	0.856083	0.591667	
2.0	5001.0	84005.0	0.873399	1.0	0.856335	0.600000	
5.0	5001.0	83974.0	0.873399	1.0	0.856335	0.600000	
10.0	5001.0	84027.2	0.873399	1.0	0.856335	0.600000	
15.0	5001.0	83858.2	0.873399	1.0	0.856335	0.600000	
20.0	5001.0	83902.0	0.873399	1.0	0.856335	0.600000	
30.0	5001.0	84049.0	0.873399	1.0	0.856335	0.600000	
40.0	5001.0	83967.8	0.873399	1.0	0.856335	0.600000	
50.0	5001.0	83880.4	0.873399	1.0	0.856335	0.600000	
1.0	5001.0	84330.2	0.874907	1.0	0.858830	0.608333	
1.5	5001.0	84330.6	0.876673	1.0	0.853374	0.625000	
0.5	5001.0	87101.4	0.879017	1.0	0.892927	0.566667	
0.25	5001.0	83918.6	0.879179	1.0	0.800599	0.750000	

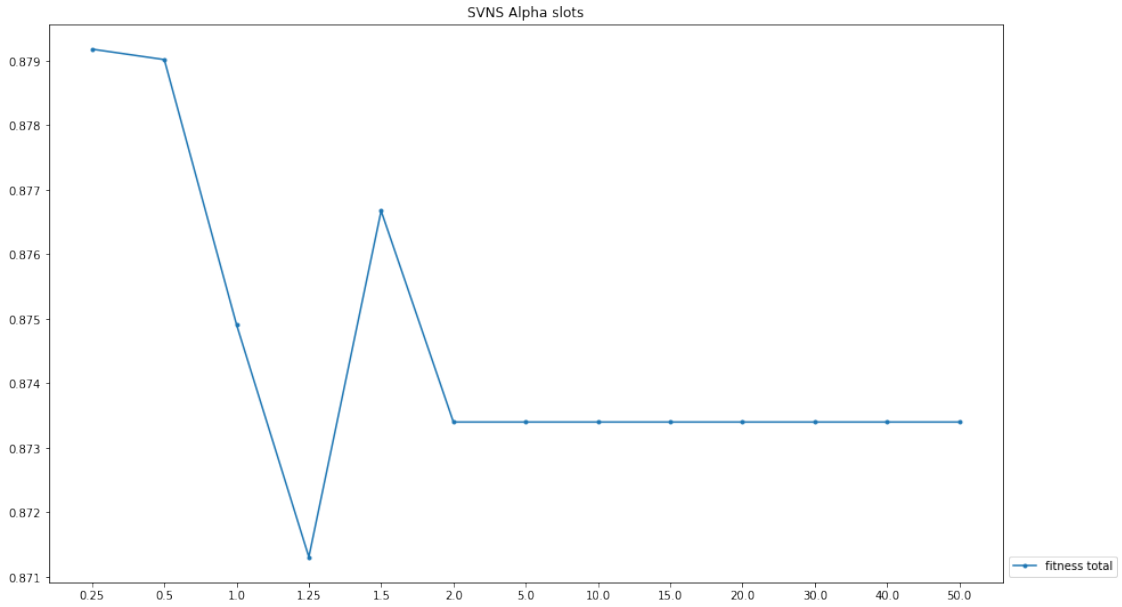
	fitness 4	tamaño	porcentajeMejora	mejor fitness	distancia	\
1.25	0.523581	24.0	0.0	0.871307	0.166	
2.0	0.536478	24.0	0.0	0.873399	0.217	
5.0	0.536478	24.0	0.0	0.873399	0.217	
10.0	0.536478	24.0	0.0	0.873399	0.217	
15.0	0.536478	24.0	0.0	0.873399	0.217	
20.0	0.536478	24.0	0.0	0.873399	0.217	
30.0	0.536478	24.0	0.0	0.873399	0.217	
40.0	0.536478	24.0	0.0	0.873399	0.217	
50.0	0.536478	24.0	0.0	0.873399	0.217	
1.0	0.529550	24.0	0.0	0.874907	0.223	
1.5	0.541857	24.0	0.0	0.876673	0.156	
0.5	0.548784	24.0	0.0	0.879017	0.199	
0.25	0.508622	24.0	0.0	0.879179	0.132	

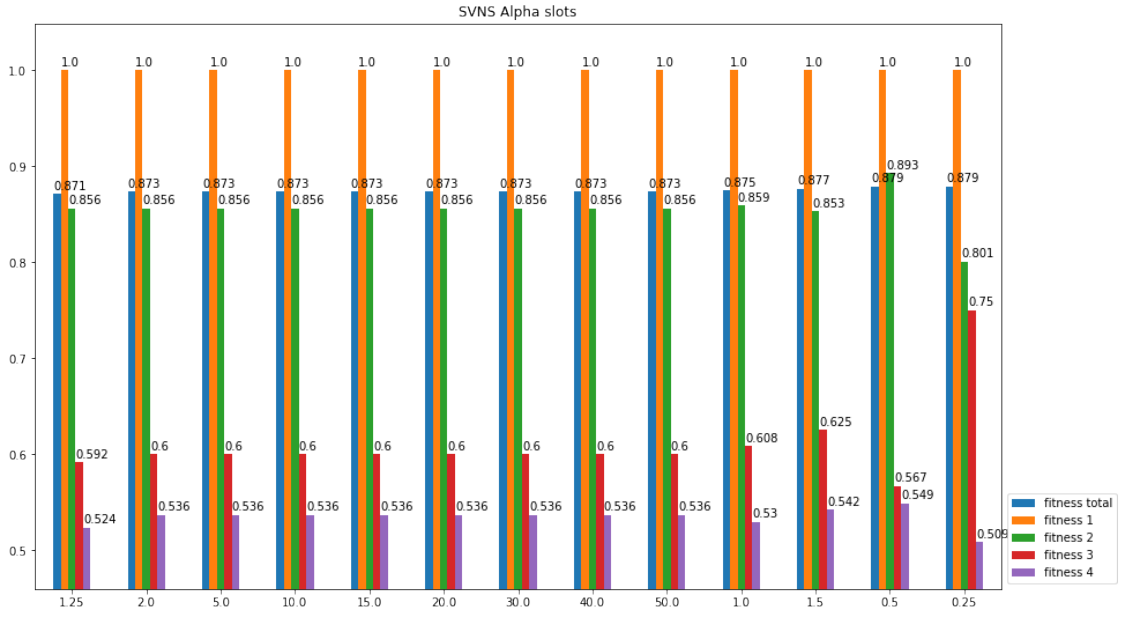
	restricciones incumplidas	reinicios	std. iteracion	std. tiempo (ms)	\

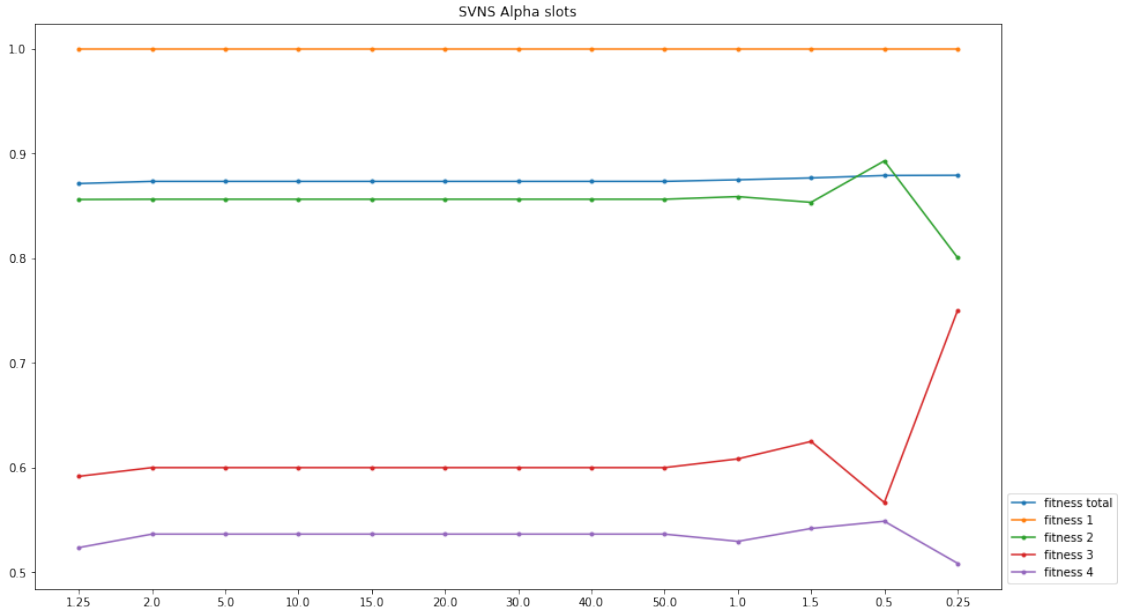
1.25	62.172222	1.0	0.0	1368.337860
2.0	62.063333	1.0	0.0	1276.004898
5.0	62.063333	1.0	0.0	1348.814850
10.0	62.063333	1.0	0.0	1212.166531
15.0	62.063333	1.0	0.0	1241.705964
20.0	62.063333	1.0	0.0	1075.888702
30.0	62.063333	1.0	0.0	1348.593156
40.0	62.063333	1.0	0.0	1328.516729
50.0	62.063333	1.0	0.0	1297.550500
1.0	60.985556	1.0	0.0	1667.658298
1.5	63.342222	1.0	0.0	1889.485591
0.5	46.255556	1.0	0.0	1361.765325
0.25	86.141111	1.0	0.0	873.166536

	std. fitness total	std. tamaño
1.25	0.006540	0.0
2.0	0.012159	0.0
5.0	0.012159	0.0
10.0	0.012159	0.0
15.0	0.012159	0.0
20.0	0.012159	0.0
30.0	0.012159	0.0
40.0	0.012159	0.0
50.0	0.012159	0.0
1.0	0.006401	0.0
1.5	0.013240	0.0
0.5	0.018834	0.0
0.25	0.006110	0.0




SVNS Alpha slots
0.879
0.878
0.877
0.876
0.875
0.874
0.873
0.872
0.871
0.25
0.5
1.0
1.25
1.5
2.0
5.0
10.0
15.0
20.0
30.0
40.0
50.0
fitness total


SVNS Alpha slots
1.0
0.9
0.8
0.7
0.6
0.5
1.25
2.0
5.0
10.0
15.0
20.0
30.0
40.0
50.0
1.0
1.5
0.5
0.25
fitness total
fitness 1
fitness 2
fitness 3
fitness 4

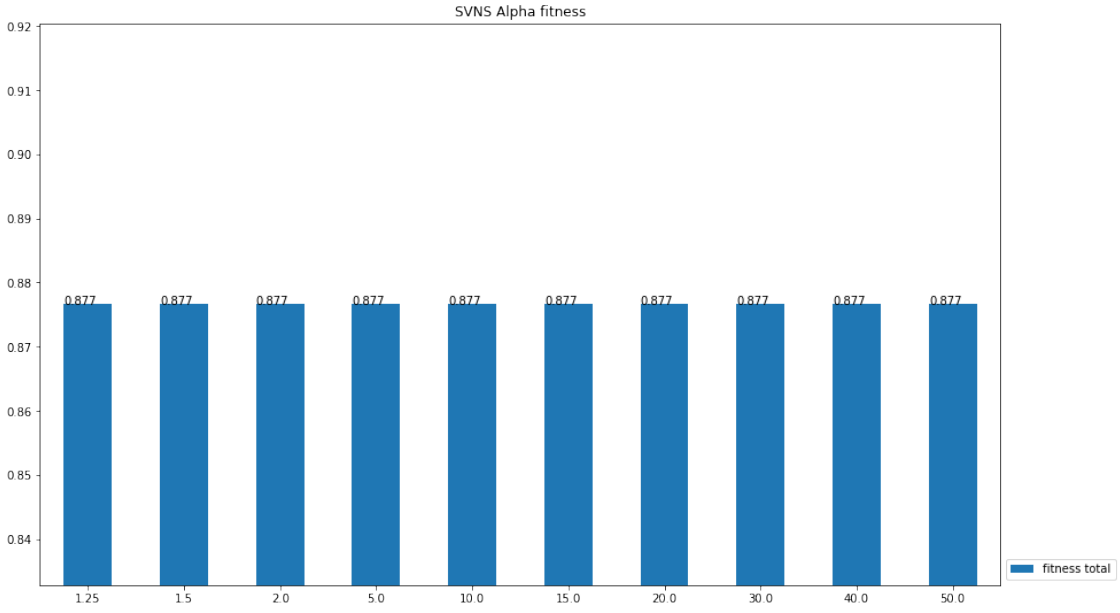


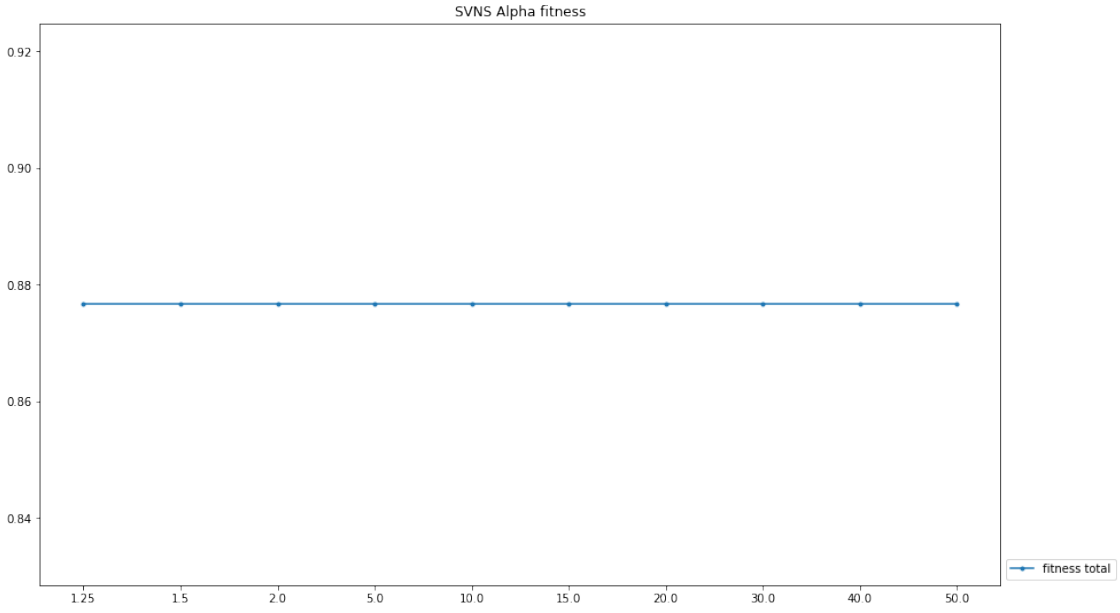
1.1.2 Función de distancia: Fitness

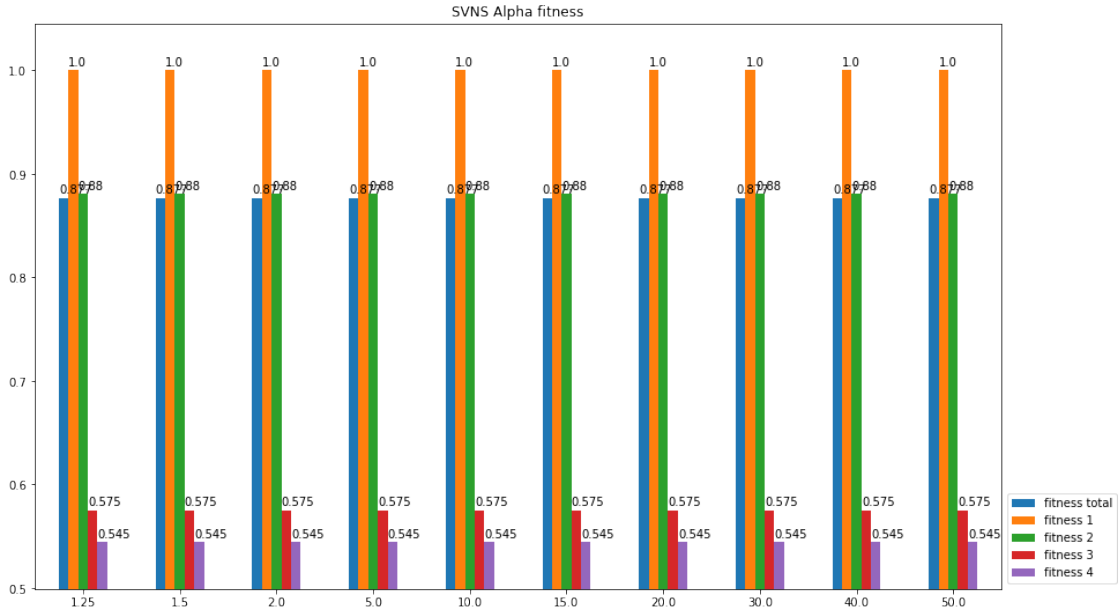
[14]:
```
base_path = BASE_URL + "1-TipoVNS\\SVNS\\fitness"
sub_paths = get_subpaths(base_path, key=float)

parametro="SVNS Alpha fitness"
out_path="1-2 "+parametro+"/"

ajuste_parametrico(base_path, sub_paths, out_path, parametro)
```

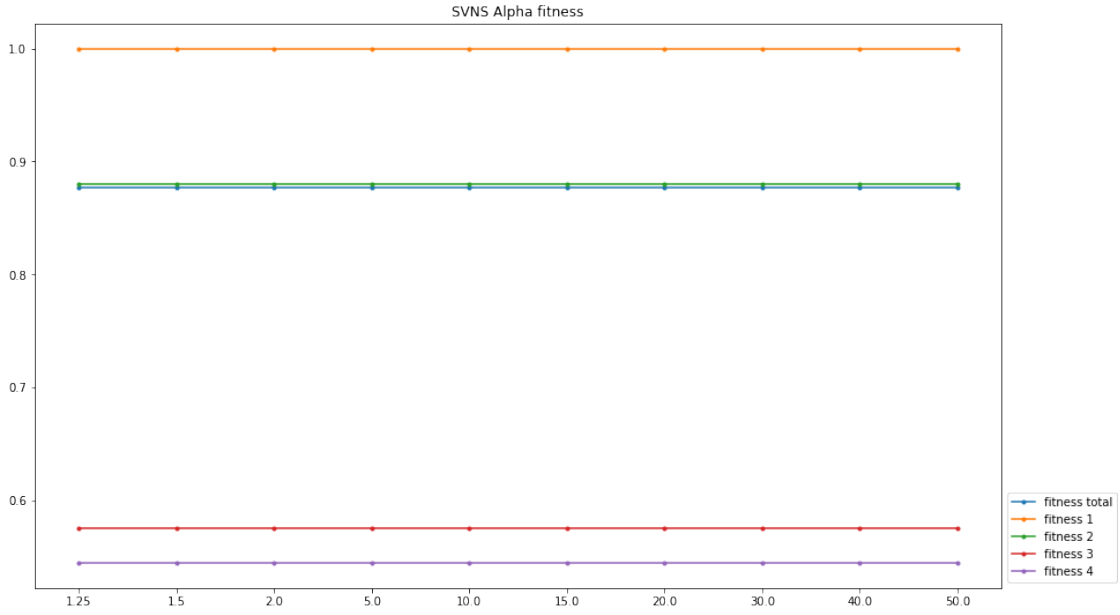
```
['1.25', '1.5', '2.0', '5.0', '10.0', '15.0', '20.0', '30.0', '40.0', '50.0']

      iteracion  tiempo (ms)  fitness total  fitness 1  fitness 2  fitness 3  \
1.25     5001.0      85551.6       0.876634        1.0   0.880388      0.575
1.5      5001.0      84983.8       0.876634        1.0   0.880388      0.575
2.0      5001.0      84623.6       0.876634        1.0   0.880388      0.575
5.0      5001.0      84399.6       0.876634        1.0   0.880388      0.575
10.0     5001.0      84431.2       0.876634        1.0   0.880388      0.575
15.0     5001.0      84444.0       0.876634        1.0   0.880388      0.575
20.0     5001.0      85600.0       0.876634        1.0   0.880388      0.575
30.0     5001.0      84986.2       0.876634        1.0   0.880388      0.575
40.0     5001.0      84964.8       0.876634        1.0   0.880388      0.575
50.0     5001.0      84784.6       0.876634        1.0   0.880388      0.575

      fitness 4  tamaño  porcentajeMejora  mejor fitness  distancia  \
1.25   0.544657    24.0               0.0       0.876634   0.004805
1.5    0.544657    24.0               0.0       0.876634   0.004805
```

```
2.0    0.544657    24.0              0.0       0.876634   0.004805
5.0    0.544657    24.0              0.0       0.876634   0.004805
10.0   0.544657    24.0              0.0       0.876634   0.004805
15.0   0.544657    24.0              0.0       0.876634   0.004805
20.0   0.544657    24.0              0.0       0.876634   0.004805
30.0   0.544657    24.0              0.0       0.876634   0.004805
40.0   0.544657    24.0              0.0       0.876634   0.004805
50.0   0.544657    24.0              0.0       0.876634   0.004805

      restricciones incumplidas  reinicios  std. iteracion  std. tiempo (ms)  \
1.25                  51.672222        1.0             0.0       1477.686469
1.5                   51.672222        1.0             0.0       1333.733369
2.0                   51.672222        1.0             0.0       1376.264437
5.0                   51.672222        1.0             0.0       1811.322528
10.0                  51.672222        1.0             0.0       1482.426120
15.0                  51.672222        1.0             0.0       1618.875072
20.0                  51.672222        1.0             0.0       1440.738179
30.0                  51.672222        1.0             0.0       1560.986771
40.0                  51.672222        1.0             0.0       1945.245923
50.0                  51.672222        1.0             0.0       1378.276206

      std. fitness total  std. tamaño
1.25            0.012456          0.0
1.5             0.012456          0.0
2.0             0.012456          0.0
5.0             0.012456          0.0
10.0            0.012456          0.0
15.0            0.012456          0.0
20.0            0.012456          0.0
30.0            0.012456          0.0
40.0            0.012456          0.0
50.0            0.012456          0.0


C:\Users\GL753V\Documents\Projects\TFM-graficador\ajuste-parametrico\ajuste-
parametrico.py:74: UserWarning: Attempting to set identical bottom == top ==
0.8766343010521576 results in singular transformations; automatically expanding.
  plt.ylim([low - 0.1 * (high - low), high + 0.1 * (high - low)])
```


SVNS Alpha fitness
0.92
0.91
0.90
0.89
0.88
0.87
0.86
0.85
0.84
0.877
1.25
1.5
2.0
5.0
10.0
15.0
20.0
30.0
40.0
50.0
fitness total


SVNS Alpha fitness
0.92
0.90
0.88
0.86
0.84
1.25
1.5
2.0
5.0
10.0
15.0
20.0
30.0
40.0
50.0
fitness total





En vista de los resultados anteriores, podemos decir que los resultados son mejores empleando como función de distancia la diferencia entre los fitness, con un apha de 1

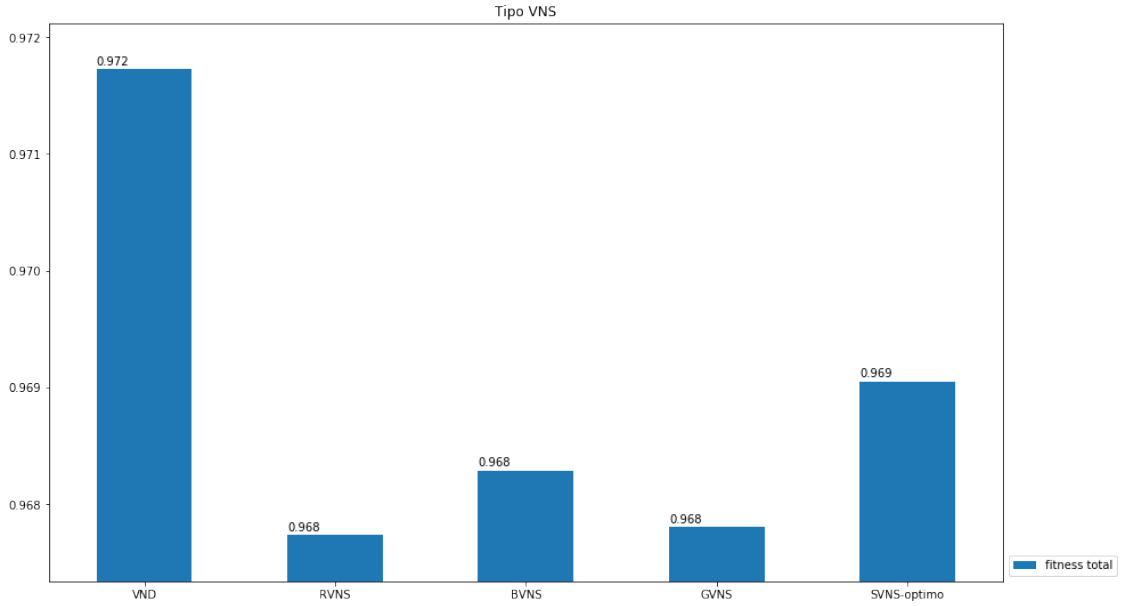
$$\alpha = 1$$

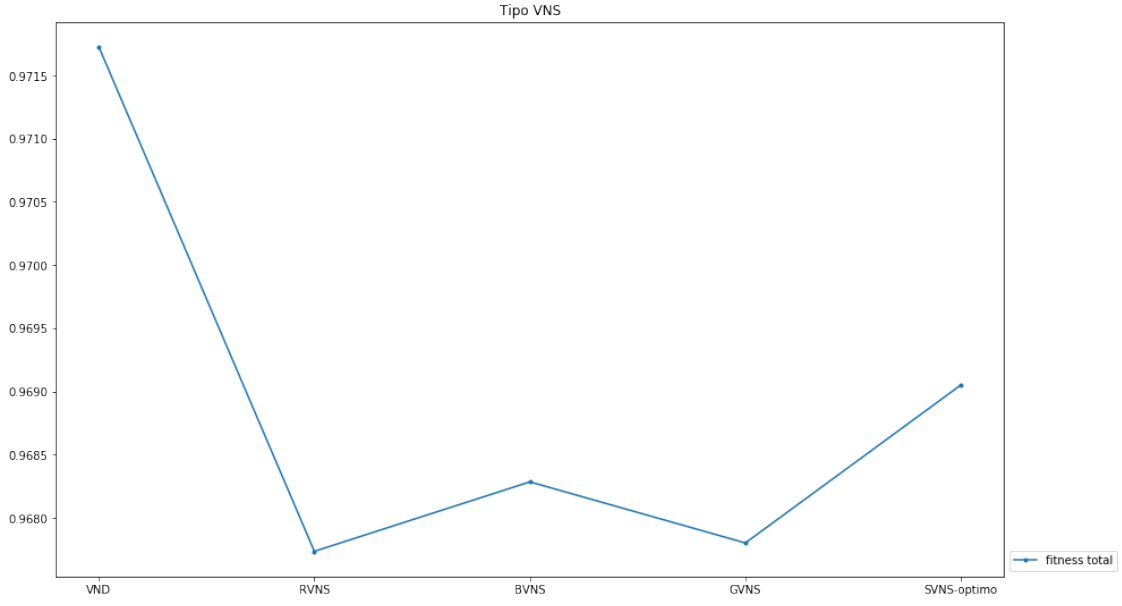
$$FuncinDistancia = \Delta fitness$$

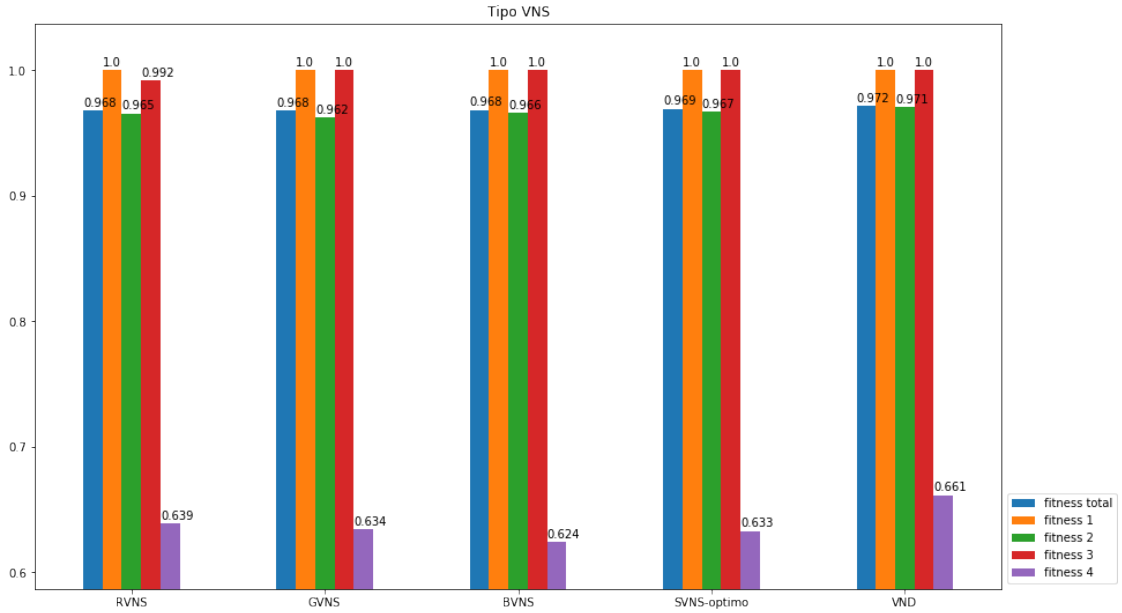
1.2 Tipo de VNS

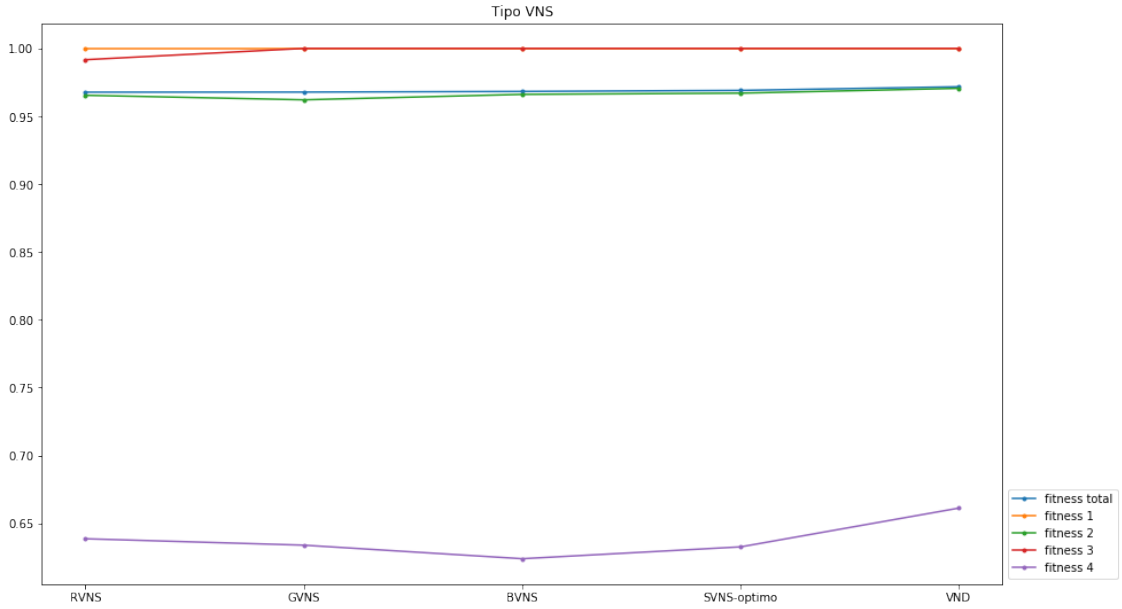
[11]:
```
base_path = BASE_URL + "1-TipoVNS"
sub_paths = ["VND", "RVNS", "BVNS", "GVNS", "SVNS-optimo"]

parametro="Tipo VNS"
out_path="1-3 "+parametro+"/"

ajuste_parametrico(base_path, sub_paths, out_path, parametro)
```

```
['VND', 'RVNS', 'BVNS', 'GVNS', 'SVNS-optimo']

             iteracion  tiempo (ms)  fitness total  fitness 1  fitness 2  \
RVNS           31001.0      51945.0       0.967734        1.0   0.965442
GVNS           31001.0     371246.6       0.967800        1.0   0.962106
BVNS           31501.0     372375.4       0.968284        1.0   0.966115
SVNS-optimo    31001.0     361323.8       0.969050        1.0   0.967014
VND            16501.0     141246.7       0.971726        1.0   0.970570

             fitness 3  fitness 4  tamaño  porcentajeMejora  mejor fitness  \
RVNS          0.991667   0.638578    24.0          0.023270       0.967734
GVNS          1.000000   0.633861    24.0          0.017357       0.967800
BVNS          1.000000   0.623876    24.0          0.015437       0.968284
SVNS-optimo   1.000000   0.632609    24.0          0.019637       0.969050
VND           1.000000   0.661201    24.0          0.011085       0.971726

             distancia  std. iteracion  std. tiempo (ms)  std. fitness total  \
RVNS         -1.000000     7745.966692      12782.203018            0.003921
GVNS         -1.000000     8432.740427     103106.318355            0.002899
BVNS         -1.000000     6687.467549      72748.379330            0.001487
SVNS-optimo   0.006811    10219.806478     110572.669733            0.003338
VND          -1.000000     3374.742789      29504.210905            0.001830

             std. tamaño
RVNS                 0.0
GVNS                 0.0
BVNS                 0.0
SVNS-optimo          0.0
VND                  0.0
```


Tipo VNS
0.972
0.971
0.970
0.969
0.968
0.972
0.968
0.968
0.968
0.969
VND
RVNS
BVNS
GVNS
SVNS-optimo
fitness total


Tipo VNS
0.9715
0.9710
0.9705
0.9700
0.9695
0.9690
0.9685
0.9680
VND
RVNS
BVNS
GVNS
SVNS-optimo
fitness total





Podemos observar que los resultados del SVNS son muy similares a todos los demas, y si tenemos en cuenta que es el necesita mayor coste computacional, podemos descartarlo. En cuanto a los demás, si bien las diferencias nuevamente son mínimas, el mejor de todos es el VND, que es además el más sencillo de todos, es decir, el de menor coste computacional.

$$TipoVNS = VND$$

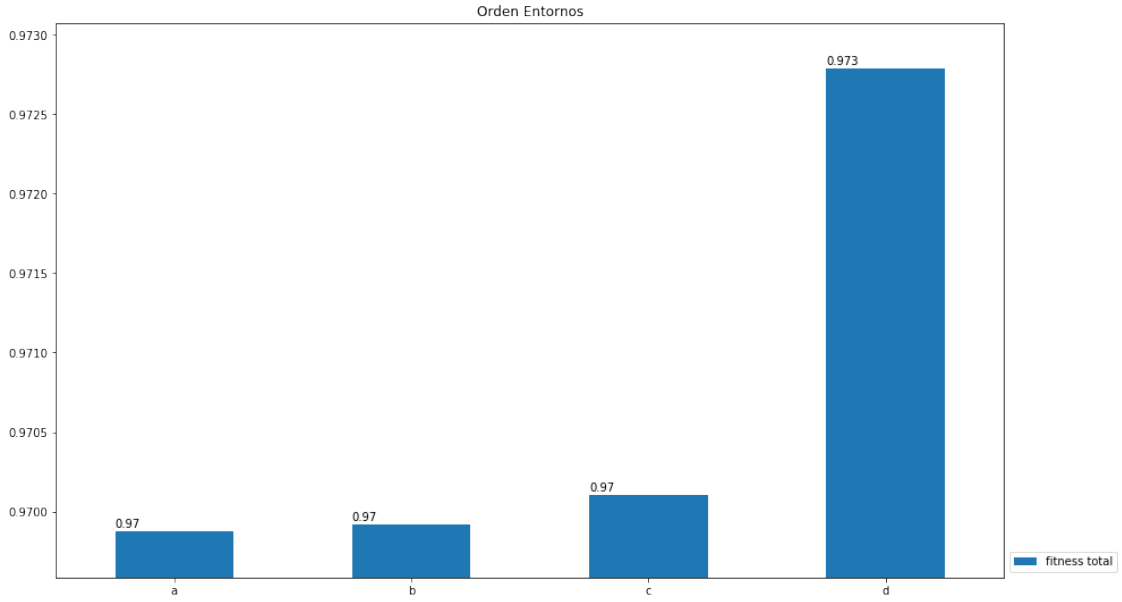
2 Estructuras de vecindad y orden

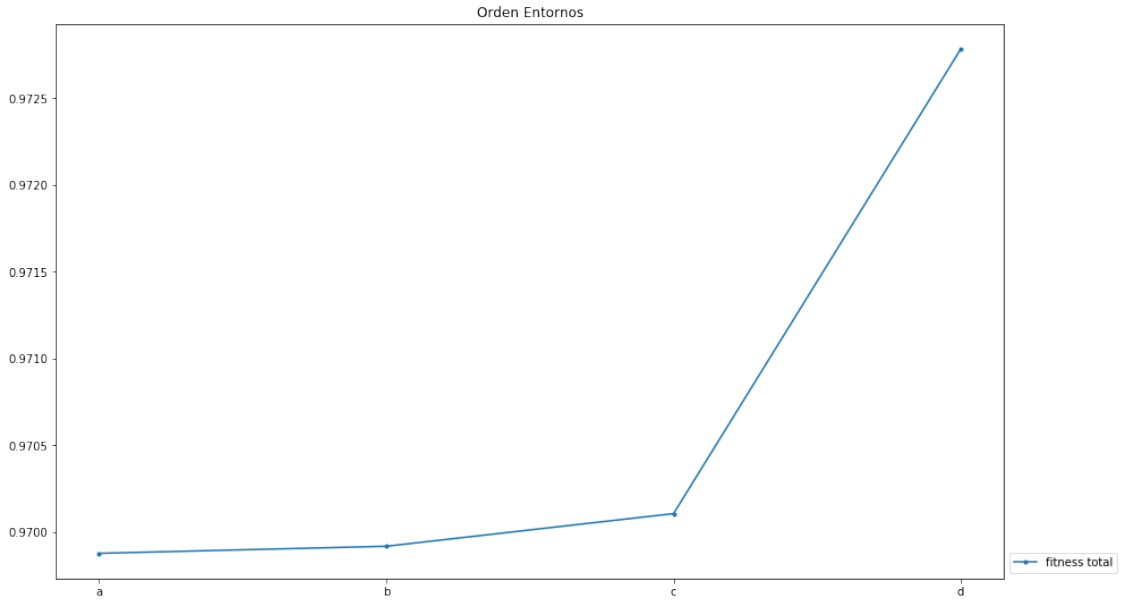
Las estructuras de vecindad propuestas son:

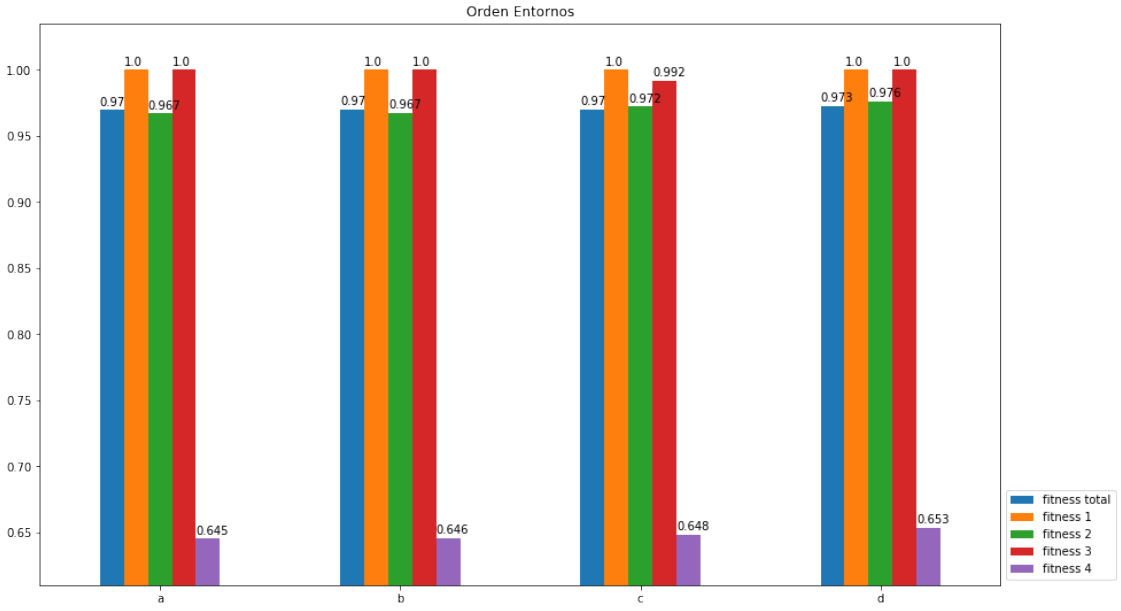
a) movRejilla, movMaxCarga.1 … movMaxCarga.4, movLibre
b) movMaxCarga, movRejilla.1 … movRejilla.4, movLibre
c) movMaxCarga.1 … movMaxCarga.4, movRejilla.1 … movRejilla.4, movLibre
d) movRejilla.1 … movRejilla.4, movMaxCarga.1 … movMaxCarga.4, movLibre

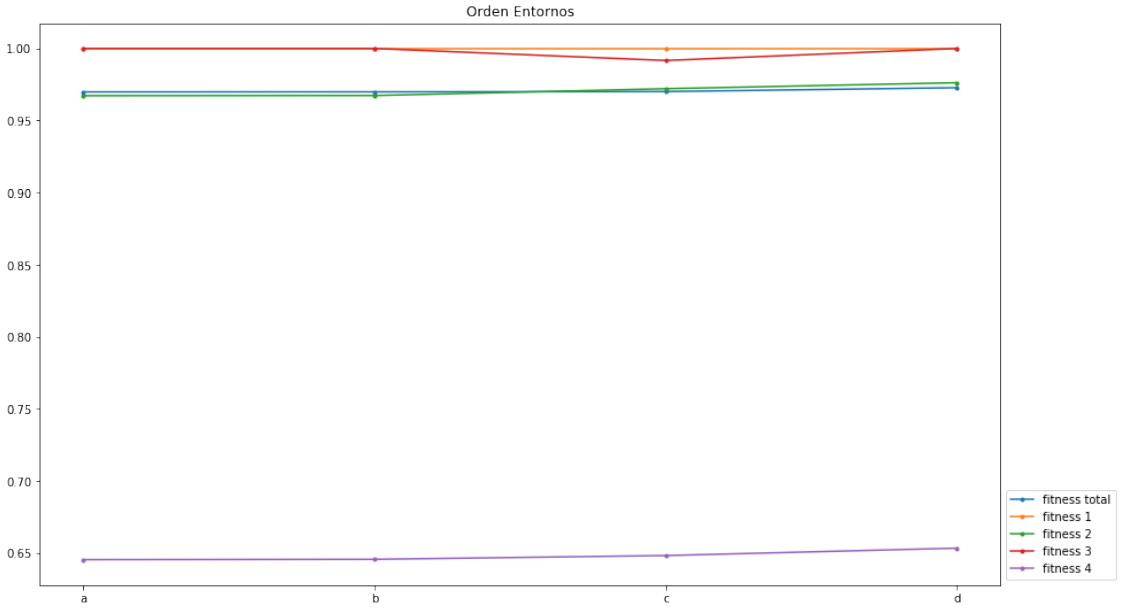
[15]:
```
base_path = BASE_URL + "2-OrdenEntornos_Bis"
sub_paths = get_subpaths(base_path)

parametro="Orden Entornos"
out_path="2 "+parametro+"/"

ajuste_parametrico(base_path, sub_paths, out_path, parametro)
```

```
['a', 'b', 'c', 'd']

   iteracion  tiempo (ms)  fitness total  fitness 1  fitness 2  fitness 3  \
a    19501.0      60012.2       0.969876        1.0   0.967247   1.000000
b    17501.0     152021.9       0.969917        1.0   0.967348   1.000000
c    15501.0     105703.1       0.970105        1.0   0.972094   0.991667
d    18501.0     126153.1       0.972785        1.0   0.976253   1.000000

   fitness 4  tamaño  porcentajeMejora  mejor fitness  distancia  \
a   0.645321    24.0          0.010391       0.969876       -1.0
b   0.645542    24.0          0.009007       0.969917       -1.0
c   0.648158    24.0          0.009377       0.970105       -1.0
d   0.653279    24.0          0.011998       0.972785       -1.0

   restricciones incumplidas  std. iteracion  std. tiempo (ms)  \
a                  14.149444     2838.231061       7805.046641
b                  14.105556     4859.126579      43417.985796
c                  12.055556     2838.231061      18344.257675
d                  10.258889     4116.363012      26103.016409

   std. fitness total  std. tamaño
a            0.002122          0.0
b            0.002841          0.0
c            0.005119          0.0
d            0.002466          0.0
```


Orden Entornos
0.9730
0.9725
0.9720
0.9715
0.9710
0.9705
0.9700
0.97
0.97
0.97
0.973
a
b
c
d
fitness total


Orden Entornos
0.9725
0.9720
0.9715
0.9710
0.9705
0.9700
a
b
c
d
fitness total


Orden Entornos
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.97
1.0
0.967
1.0
0.645
0.97
1.0
0.967
1.0
0.646
0.97
1.0
0.972
0.992
0.648
0.973
1.0
0.976
1.0
0.653
a
b
c
d
fitness total
fitness 1
fitness 2
fitness 3
fitness 4


Orden Entornos
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
a
b
c
d
fitness total
fitness 1
fitness 2
fitness 3
fitness 4

3 Naturaleza del orden de los entornos

3.1 Probabilístico

3.1.1 Probabilidad de diversificación

[16]:
```
base_path = BASE_URL + "3-Vecindades\\probabilisticos\\prob"
sub_paths = get_subpaths(base_path, key=float)

parametro = "Probabilidad Diversificacion"
out_path = "3-1 " + parametro + "/"

ajuste_parametrico(base_path, sub_paths, out_path, parametro)
```

```
['0.1', '0.2', '0.3', '0.4', '0.5', '0.6', '0.7', '0.8', '0.9', '0.95', '1.0']
```

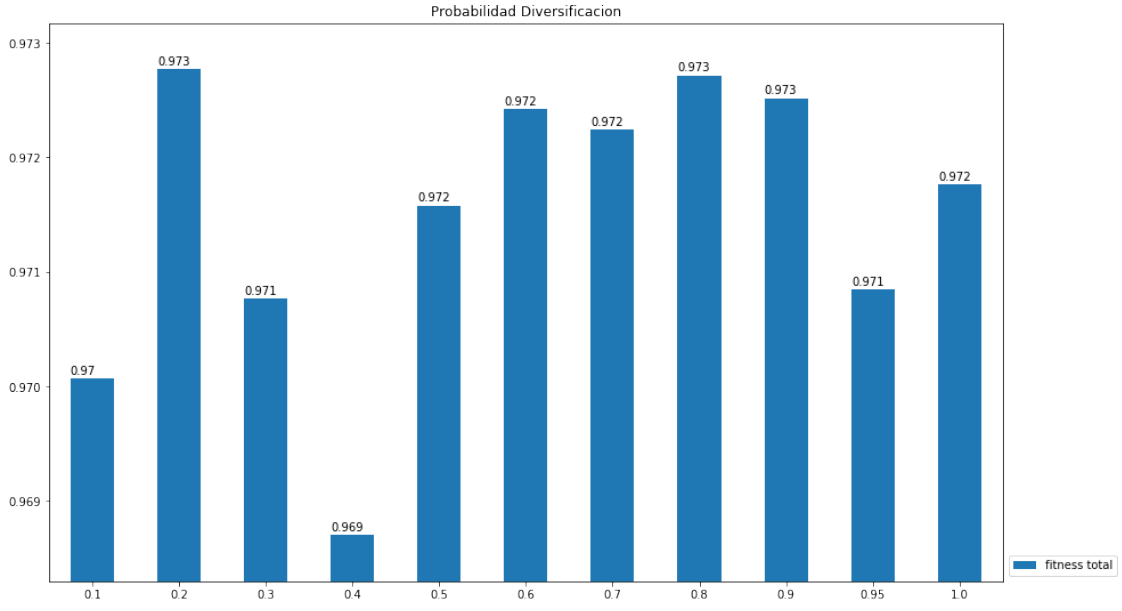
	iteracion	tiempo (ms)	fitness total	fitness 1	fitness 2	fitness 3	\
0.4	21501.0	183128.2	0.968705	1.0	0.961929	1.0	
0.1	16501.0	138304.2	0.970069	1.0	0.967649	1.0	
0.3	17001.0	139842.9	0.970765	1.0	0.969338	1.0	
0.95	19001.0	157625.3	0.970849	1.0	0.969187	1.0	
0.5	17001.0	145786.5	0.971580	1.0	0.971316	1.0	
1.0	16501.0	136258.7	0.971763	1.0	0.972272	1.0	
0.7	19001.0	159802.4	0.972241	1.0	0.971732	1.0	
0.6	17001.0	139629.1	0.972423	1.0	0.973947	1.0	
0.9	18001.0	151563.7	0.972517	1.0	0.975194	1.0	
0.8	20501.0	173504.5	0.972713	1.0	0.973744	1.0	
0.2	22501.0	186136.5	0.972769	1.0	0.973432	1.0	

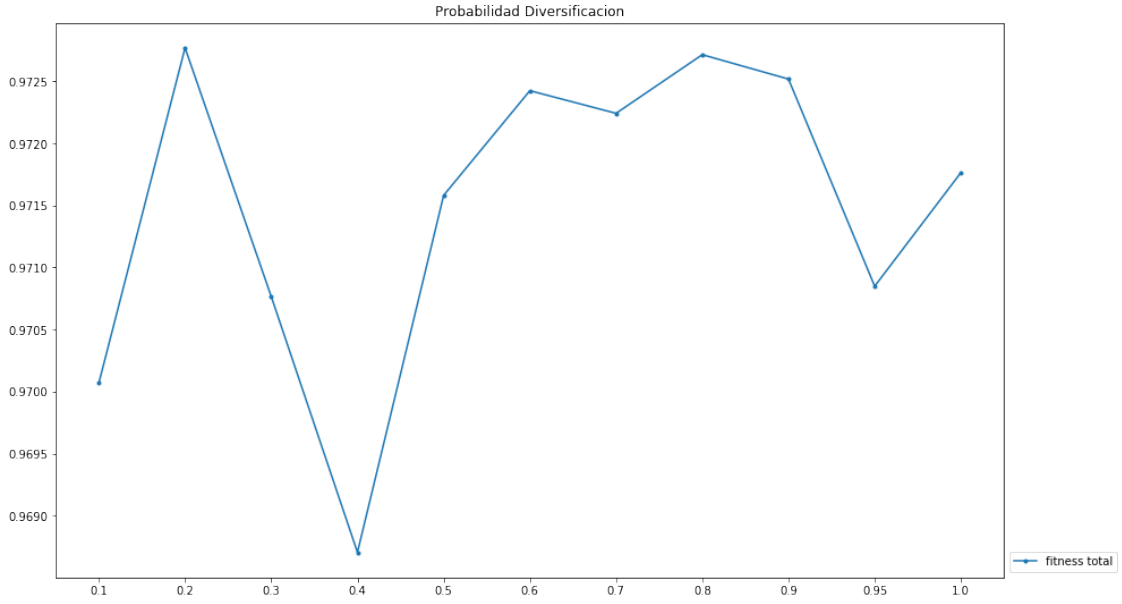
	fitness 4	tamaño	porcentajeMejora	mejor fitness	distancia	\
0.4	0.649742	24.0	0.005666	0.968705	-1.0	
0.1	0.646721	24.0	0.007564	0.970069	-1.0	
0.3	0.650737	24.0	0.007517	0.970765	-1.0	
0.95	0.652800	24.0	0.009563	0.970849	-1.0	
0.5	0.655416	24.0	0.011357	0.971580	-1.0	
1.0	0.654164	24.0	0.011405	0.971763	-1.0	
0.7	0.664554	24.0	0.010738	0.972241	-1.0	
0.6	0.657627	24.0	0.006632	0.972423	-1.0	
0.9	0.653574	24.0	0.006632	0.972517	-1.0	
0.8	0.663375	24.0	0.015033	0.972713	-1.0	
0.2	0.665696	24.0	0.008401	0.972769	-1.0	

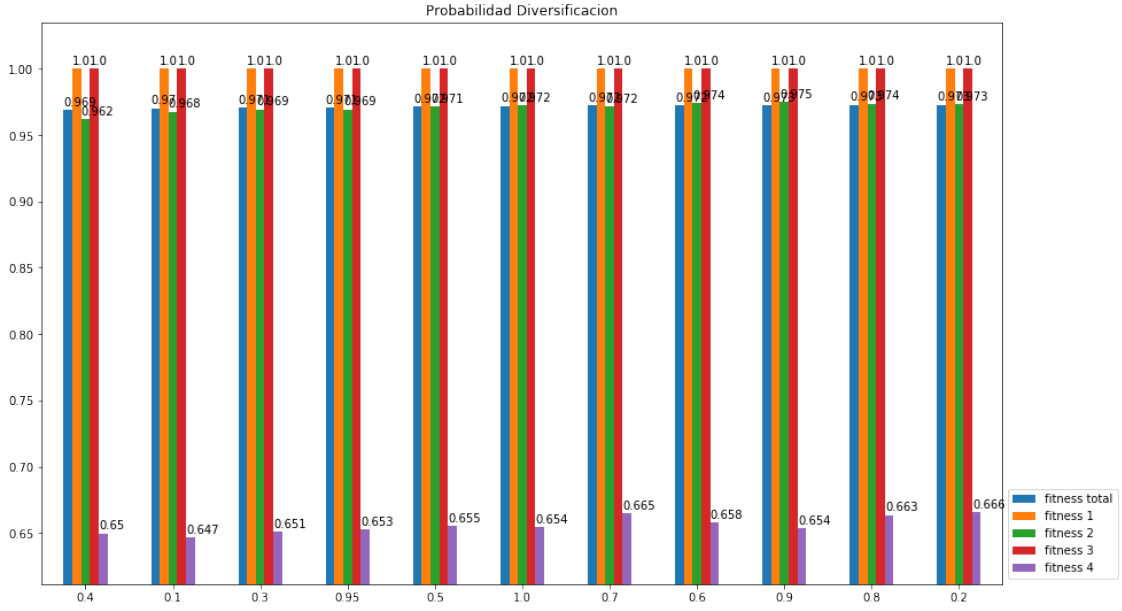
	restricciones incumplidas	std. iteracion	std. tiempo (ms)	\
0.4	16.446667	5797.509044	45762.497676	
0.1	13.975556	5797.509044	45715.370989	
0.3	13.246111	4216.370214	29090.690322	
0.95	13.311111	5676.462122	44469.420497	
0.5	12.391667	2581.988897	21814.060416	
1.0	11.978333	7090.682462	51315.290732	

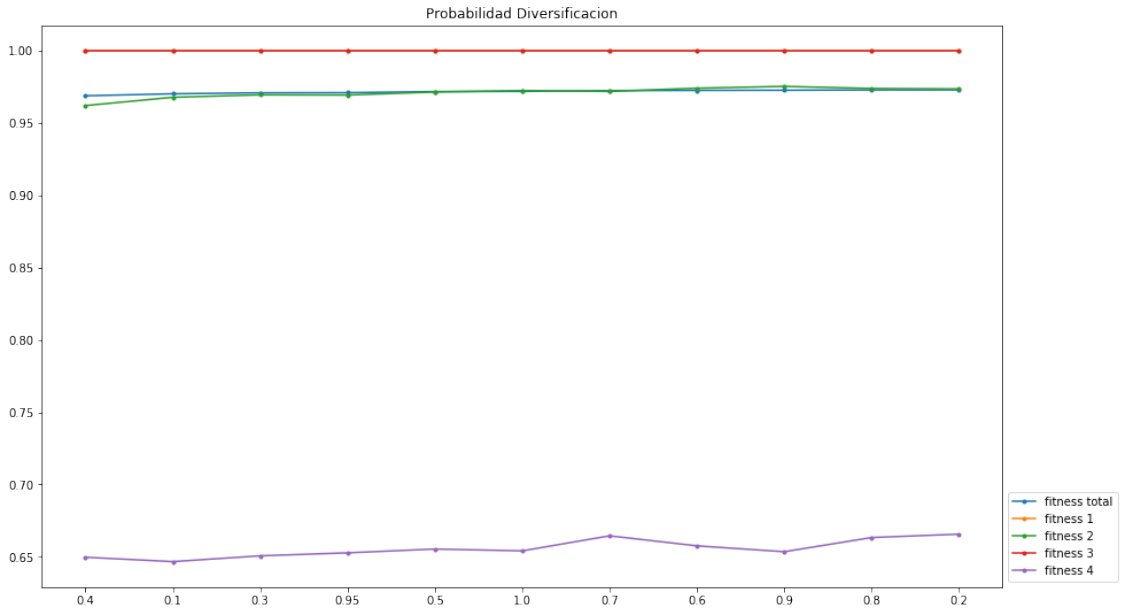
0.7	12.211667	5676.462122	49165.540510
0.6	11.255000	4216.370214	32733.737776
0.9	10.716111	4830.458915	40506.014333
0.8	11.342778	7245.688373	59861.647509
0.2	11.477222	5892.556510	45198.174819

	std. fitness total	std. tamaño
0.4	0.003735	0.0
0.1	0.002304	0.0
0.3	0.003097	0.0
0.95	0.003797	0.0
0.5	0.003079	0.0
1.0	0.003939	0.0
0.7	0.002745	0.0
0.6	0.003363	0.0
0.9	0.001688	0.0
0.8	0.002113	0.0
0.2	0.003040	0.0




Probabilidad Diversificacion
0.9725
0.9720
0.9715
0.9710
0.9705
0.9700
0.9695
0.9690
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0.95
1.0
fitness total


Probabilidad Diversificacion
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.4
0.1
0.3
0.95
0.5
1.0
0.7
0.6
0.9
0.8
0.2
0.65
0.647
0.651
0.653
0.655
0.654
0.665
0.658
0.654
0.663
0.666
fitness total
fitness 1
fitness 2
fitness 3
fitness 4



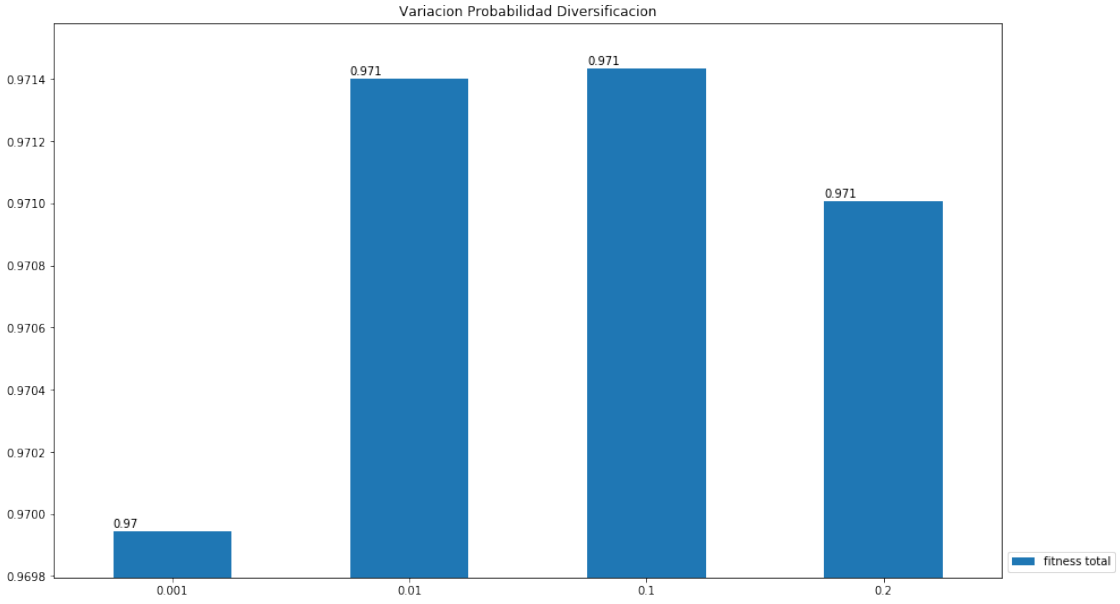
3.1.2 Variación de la probabilidad de diversificación

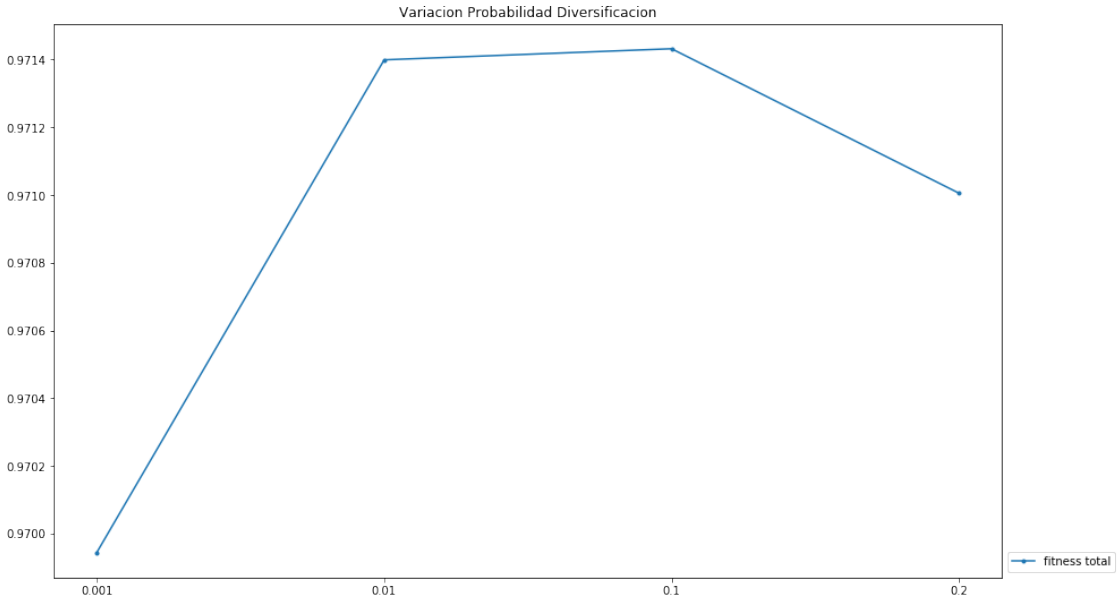
[17]:
```
base_path = BASE_URL + "3-Vecindades\\probabilisticos\\var"
sub_paths = get_subpaths(base_path, key=float)

parametro = "Variacion Probabilidad Diversificacion"
out_path = "3-2 " + parametro + "/"

ajuste_parametrico(base_path, sub_paths, out_path, parametro)
```

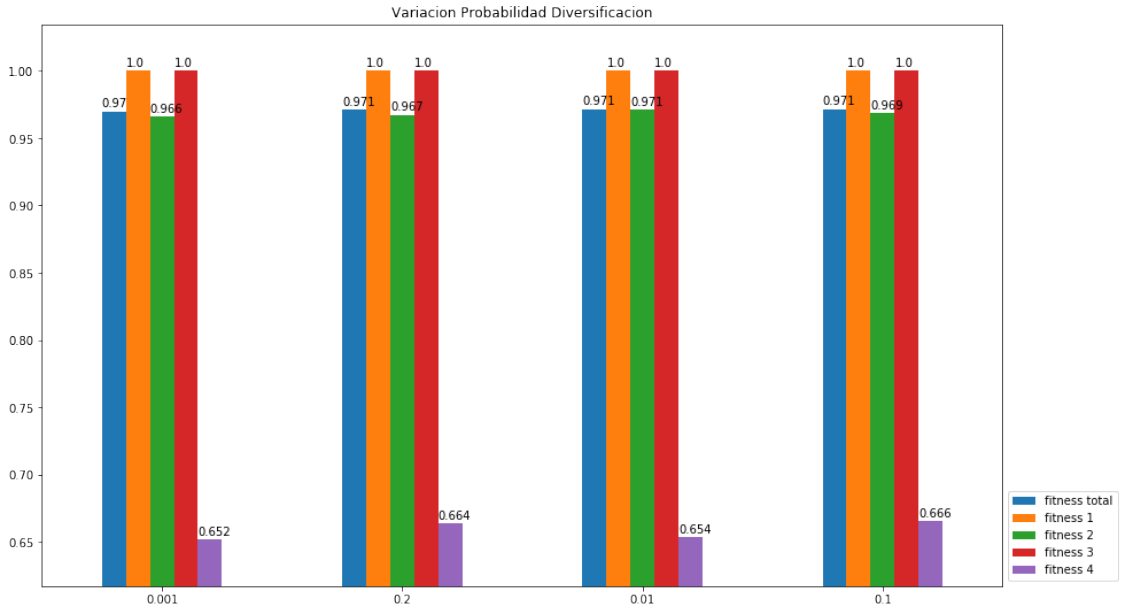
```
['0.001', '0.01', '0.1', '0.2']

       iteracion  tiempo (ms)  fitness total  fitness 1  fitness 2  fitness 3  \
0.001    18001.0     151145.7       0.969944        1.0   0.966049        1.0
0.2      21501.0     179948.6       0.971006        1.0   0.967370        1.0
0.01     17001.0     143702.1       0.971400        1.0   0.971048        1.0
0.1      15501.0     133200.8       0.971432        1.0   0.968525        1.0

       fitness 4  tamaño  porcentajeMejora  mejor fitness  distancia  \
0.001   0.651842    24.0          0.010893       0.969944       -1.0
0.2     0.663596    24.0          0.008483       0.971006       -1.0
0.01    0.653611    24.0          0.007517       0.971400       -1.0
0.1     0.665512    24.0          0.014019       0.971432       -1.0

       restricciones incumplidas  std. iteracion  std. tiempo (ms)  \
0.001                  14.666667     5374.838499      47799.835634
0.2                    14.096111     6687.467549      53296.160631
```

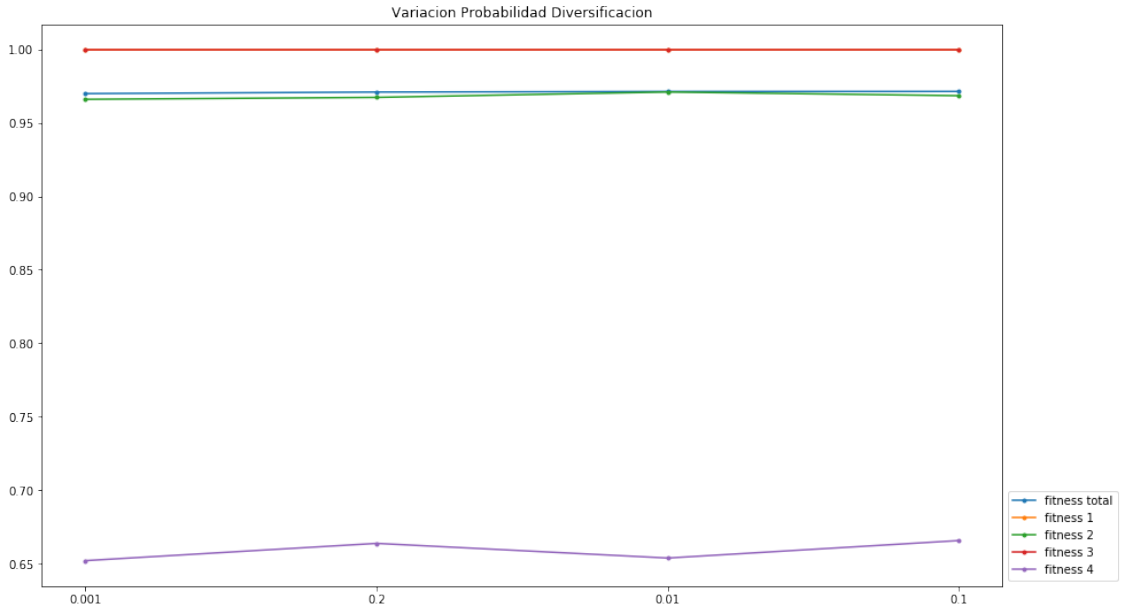
0.01	12.507222	2581.988897	21065.511790
0.1	13.597222	1581.138830	13806.302657

	std. fitness total	std. tamaño
0.001	0.001696	0.0
0.2	0.003174	0.0
0.01	0.002056	0.0
0.1	0.002817	0.0






Variacion Probabilidad Diversificacion
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.97
1.0
0.966
1.0
0.652
0.971
1.0
0.967
1.0
0.664
0.971
1.0
0.971
1.0
0.654
0.971
1.0
0.969
1.0
0.666
0.001
0.2
0.01
0.1
fitness total
fitness 1
fitness 2
fitness 3
fitness 4


Variacion Probabilidad Diversificacion
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.001
0.2
0.01
0.1
fitness total
fitness 1
fitness 2
fitness 3
fitness 4

3.1.3 Numero de iteraciones sin variar la probabilidad de diversificación

[18]:
```
base_path = BASE_URL + "3-Vecindades\\probabilisticos\\iter"
sub_paths = get_subpaths(base_path, key=float)

parametro = "Ciclos Probabilidad Diversificacion"
out_path = "3-3 " + parametro + "/"

ajuste_parametrico(base_path, sub_paths, out_path, parametro)
```

```
['1.0', '5.0', '10.0', '25.0', '50.0', '60.0', '65.0', '70.0', '75.0', '80.0',
'85.0', '90.0', '95.0', '100.0', '1000.0']
```

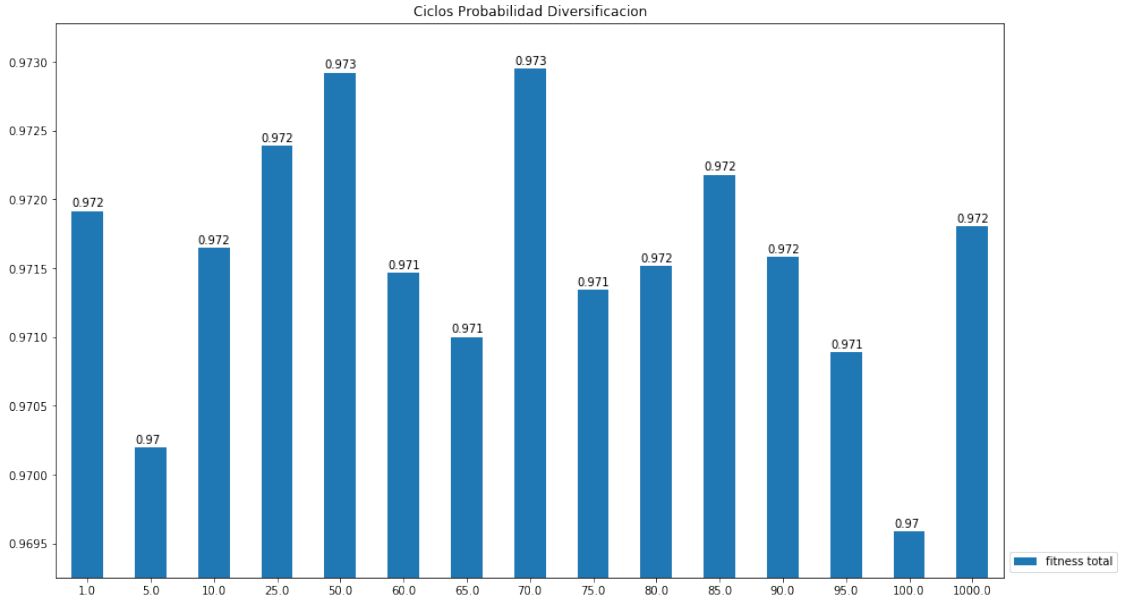
	iteracion	tiempo (ms)	fitness total	fitness 1	fitness 2	\
100.0	19001.0	163391.0	0.969588	1.0	0.964019	
5.0	17501.0	149121.7	0.970194	1.0	0.968023	
95.0	17501.0	146374.5	0.970888	1.0	0.968358	
65.0	20501.0	172944.4	0.970999	1.0	0.970710	
75.0	21001.0	173714.1	0.971341	1.0	0.970333	
60.0	18501.0	154758.5	0.971463	1.0	0.969284	
80.0	18001.0	153734.2	0.971512	1.0	0.970932	
90.0	18001.0	149804.1	0.971580	1.0	0.970251	
10.0	16501.0	140942.9	0.971648	1.0	0.972189	
1000.0	17501.0	152258.9	0.971803	1.0	0.972274	
1.0	17501.0	147330.2	0.971916	1.0	0.972697	
85.0	19001.0	163392.9	0.972177	1.0	0.973002	
25.0	18501.0	155784.0	0.972386	1.0	0.971704	
50.0	18501.0	156375.6	0.972919	1.0	0.975643	
70.0	19001.0	162373.6	0.972947	1.0	0.975854	

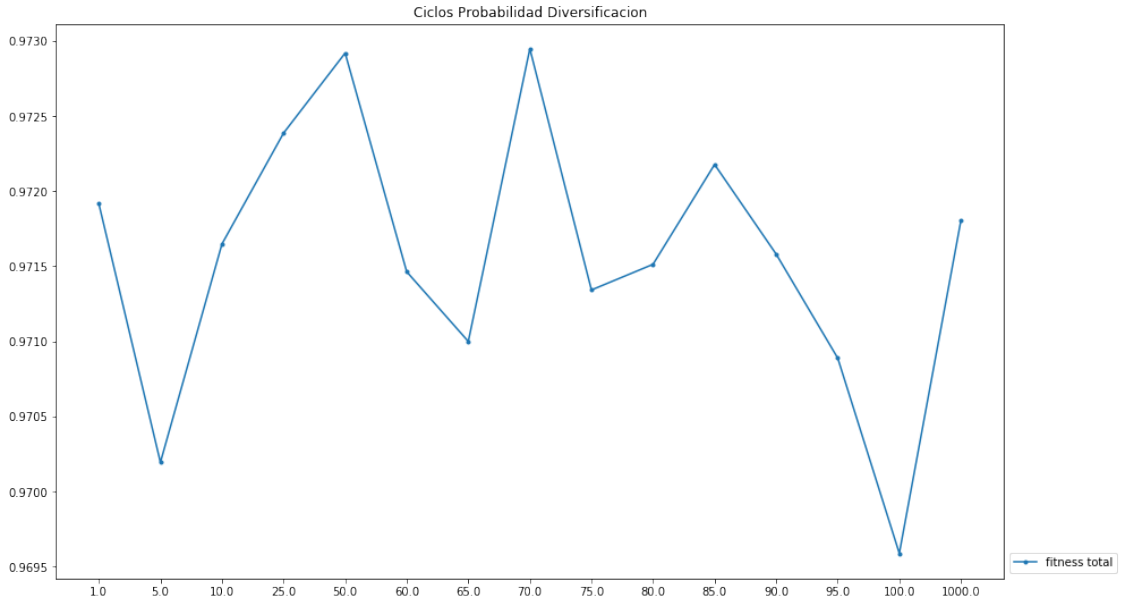
	fitness 3	fitness 4	tamaño	porcentajeMejora	mejor fitness	\
100.0	1.0	0.655048	24.0	0.007829	0.969588	
5.0	1.0	0.647126	24.0	0.012601	0.970194	
95.0	1.0	0.657185	24.0	0.008622	0.970888	
65.0	1.0	0.648452	24.0	0.011587	0.970999	
75.0	1.0	0.655859	24.0	0.004864	0.971341	
60.0	1.0	0.662601	24.0	0.009727	0.971463	
80.0	1.0	0.656006	24.0	0.010135	0.971512	
90.0	1.0	0.660206	24.0	0.009250	0.971580	
10.0	1.0	0.652616	24.0	0.018185	0.971648	
1000.0	1.0	0.654827	24.0	0.012822	0.971803	
1.0	1.0	0.654790	24.0	0.015273	0.971916	
85.0	1.0	0.657775	24.0	0.008309	0.972177	
25.0	1.0	0.667097	24.0	0.009563	0.972386	
50.0	1.0	0.658254	24.0	0.007296	0.972919	
70.0	1.0	0.657775	24.0	0.007738	0.972947	

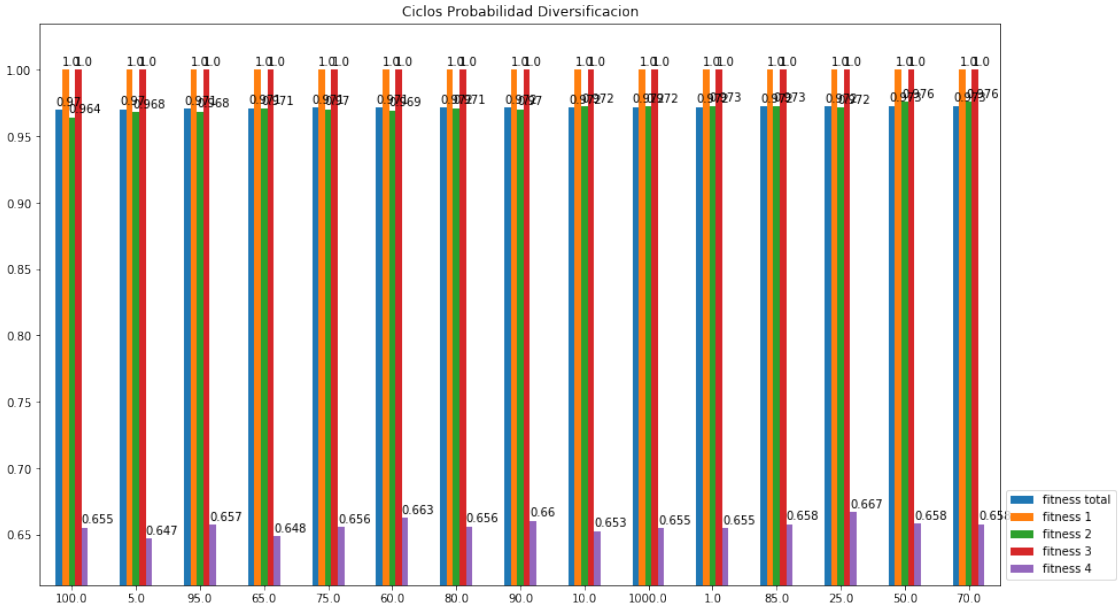
	distancia	restricciones incumplidas	std. iteracion	\

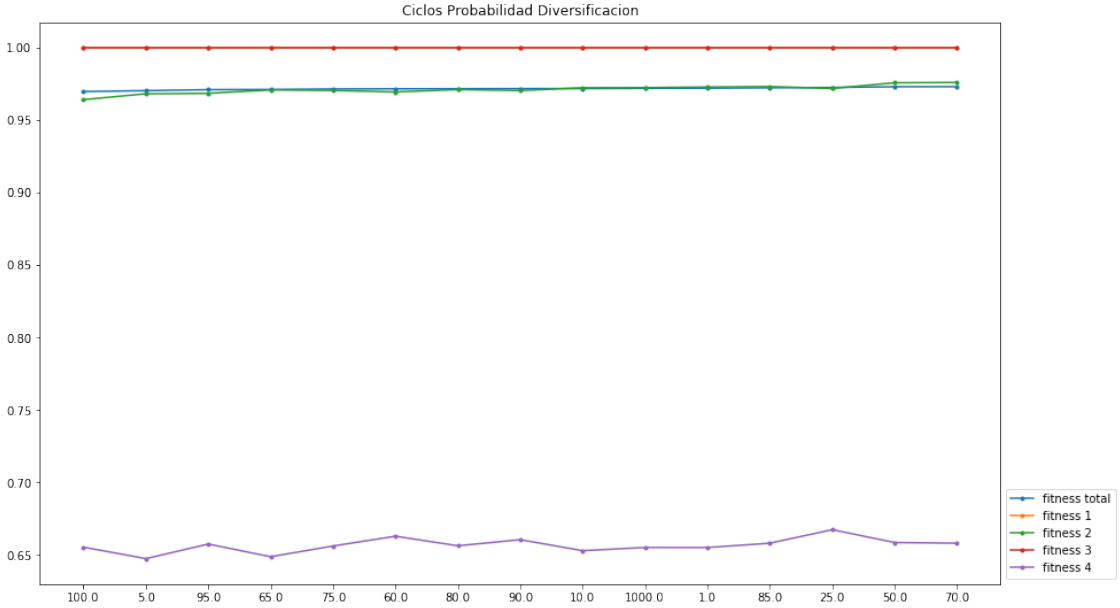
100.0	-1.0	15.543889	3944.053189
5.0	-1.0	13.813889	4859.126579
95.0	-1.0	13.669444	4859.126579
65.0	-1.0	12.653333	5502.524673
75.0	-1.0	12.816111	3944.053189
60.0	-1.0	13.269444	3374.742789
80.0	-1.0	12.557222	4830.458915
90.0	-1.0	12.851667	2581.988897
10.0	-1.0	12.014444	4116.363012
1000.0	-1.0	11.977778	3535.533906
1.0	-1.0	11.795000	2635.231383
85.0	-1.0	11.663333	5163.977795
25.0	-1.0	12.223889	4743.416490
50.0	-1.0	10.522222	4116.363012
70.0	-1.0	10.431111	3162.277660

	std. tiempo (ms)	std. fitness total	std. tamaño
100.0	33292.810298	0.002194	0.0
5.0	37651.103832	0.002653	0.0
95.0	39999.661519	0.002765	0.0
65.0	46793.245726	0.002115	0.0
75.0	31033.285963	0.002818	0.0
60.0	24160.615372	0.003209	0.0
80.0	44826.568723	0.002518	0.0
90.0	20822.078082	0.003928	0.0
10.0	34866.116842	0.003097	0.0
1000.0	31492.708562	0.002812	0.0
1.0	23790.523112	0.002748	0.0
85.0	49509.399418	0.002411	0.0
25.0	37589.358849	0.002061	0.0
50.0	32174.213002	0.002697	0.0
70.0	28418.451358	0.002395	0.0


Ciclos Probabilidad Diversificacion
0.9730
0.9725
0.9720
0.9715
0.9710
0.9705
0.9700
0.9695
0.972
0.97
0.972
0.972
0.973
0.971
0.971
0.973
0.971
0.972
0.972
0.972
0.971
0.97
0.972
1.0
5.0
10.0
25.0
50.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
1000.0
fitness total


Ciclos Probabilidad Diversificacion
0.9730
0.9725
0.9720
0.9715
0.9710
0.9705
0.9700
0.9695
1.0
5.0
10.0
25.0
50.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
1000.0
fitness total



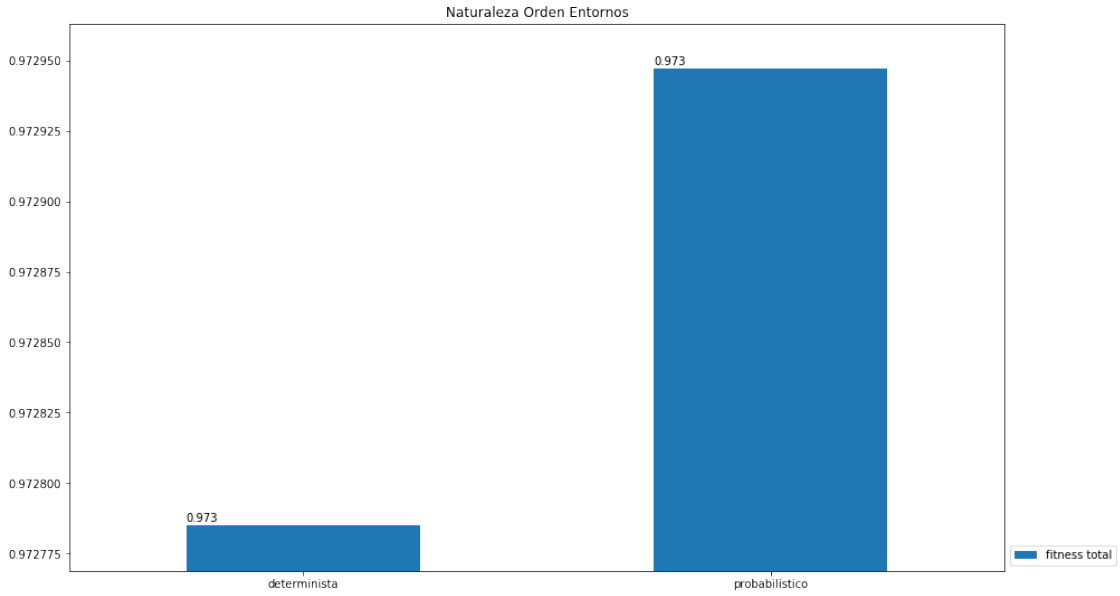


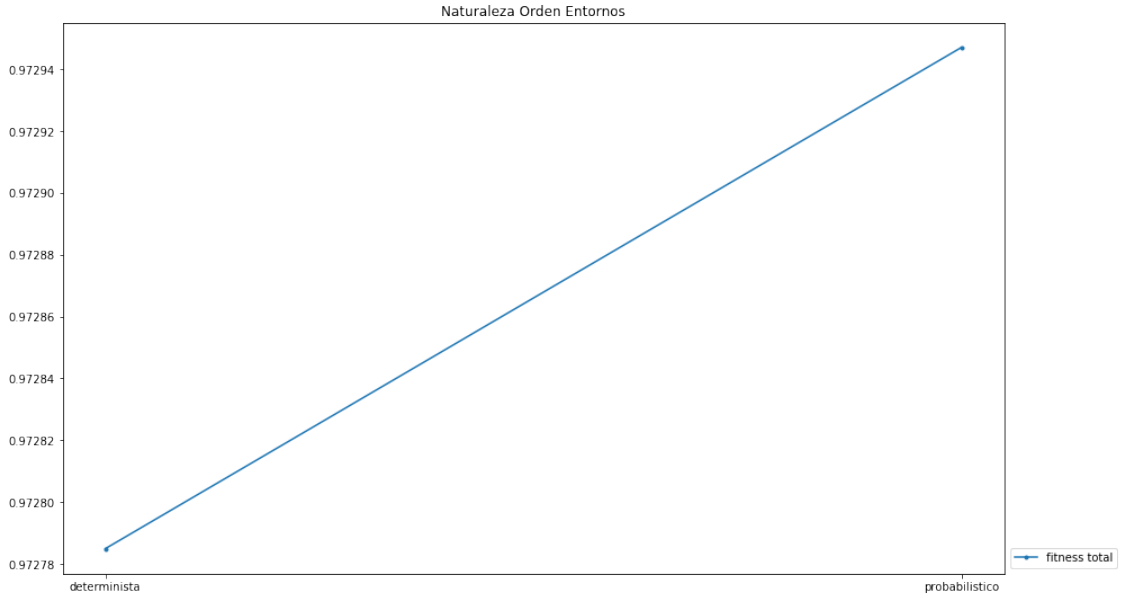
3.2 Determinista vs Probabilistico

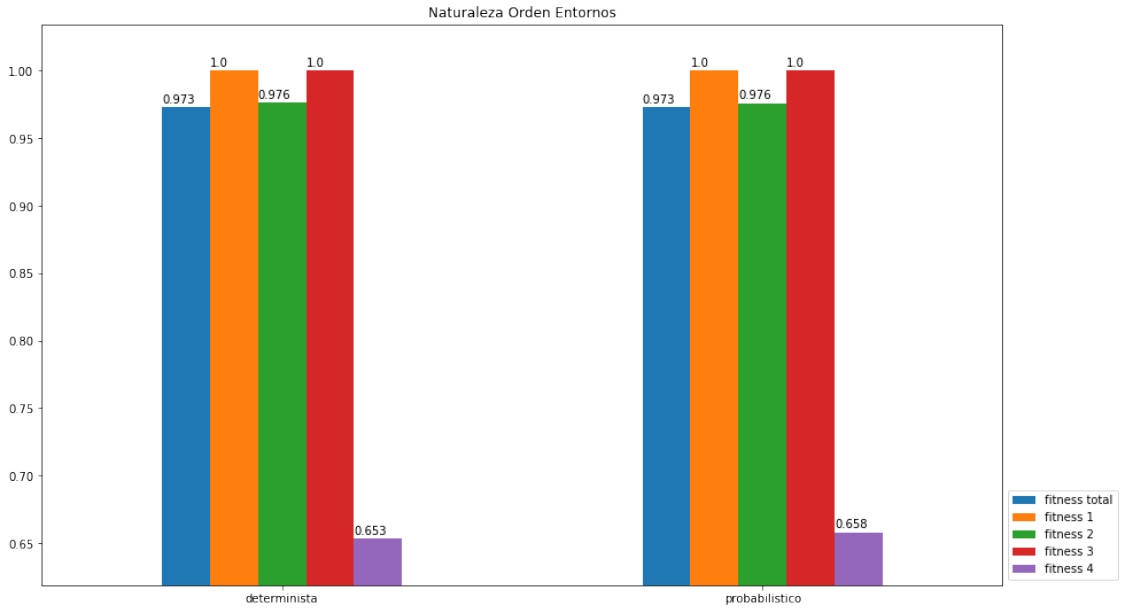
[19]:
```
base_path = BASE_URL + "3-Vecindades\\TipoEntornos"
sub_paths = ["determinista", "probabilistico"]

parametro = "Naturaleza Orden Entornos"
```

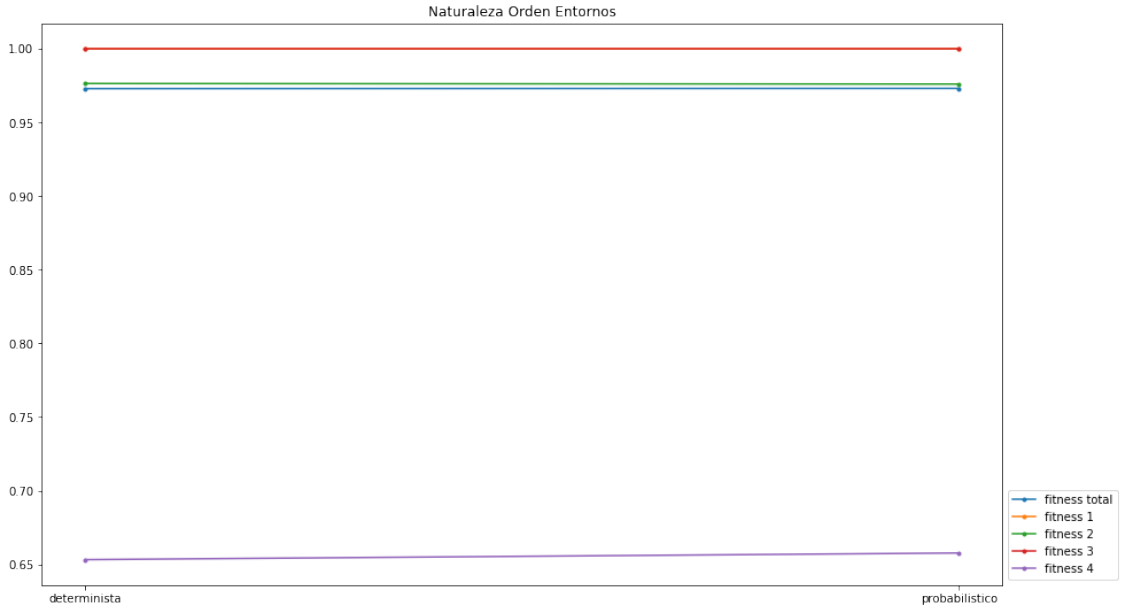
```
out_path = "3-4 " + parametro + "/"

ajuste_parametrico(base_path, sub_paths, out_path, parametro)
```

```
['determinista', 'probabilistico']

               iteracion  tiempo (ms)  fitness total  fitness 1  fitness 2  \
determinista     18501.0     126153.1       0.972785        1.0   0.976253
probabilistico   19001.0     162373.6       0.972947        1.0   0.975854

               fitness 3  fitness 4  tamaño  porcentajeMejora  mejor fitness  \
determinista         1.0   0.653279    24.0          0.011998       0.972785
probabilistico       1.0   0.657775    24.0          0.007738       0.972947

               distancia  restricciones incumplidas  std. iteracion  \
determinista        -1.0                  10.258889     4116.363012
probabilistico      -1.0                  10.431111     3162.277660

               std. tiempo (ms)  std. fitness total  std. tamaño
determinista      26103.016409            0.002466          0.0
probabilistico    28418.451358            0.002395          0.0
```




Naturaleza Orden Entornos
0.97294
0.97292
0.97290
0.97288
0.97286
0.97284
0.97282
0.97280
0.97278
determinista
probabilistico
fitness total


Naturaleza Orden Entornos
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.973
1.0
0.976
1.0
0.653
0.973
1.0
0.976
1.0
0.658
determinista
probabilistico
fitness total
fitness 1
fitness 2
fitness 3
fitness 4



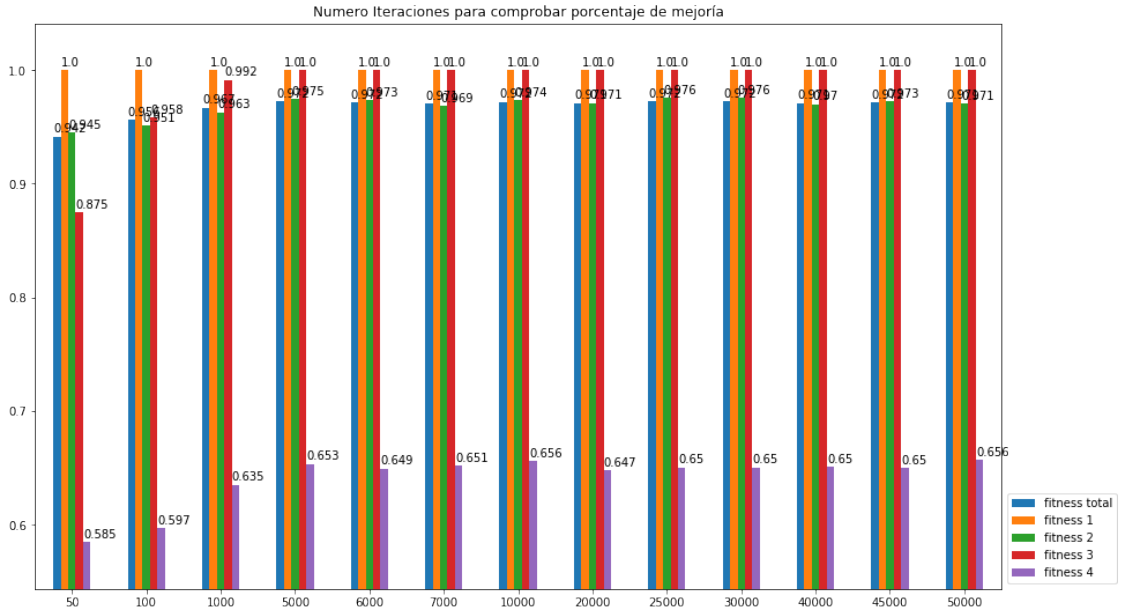
4 Número de iteraciones para comprobar el porcentaje de mejoría (ciclos)

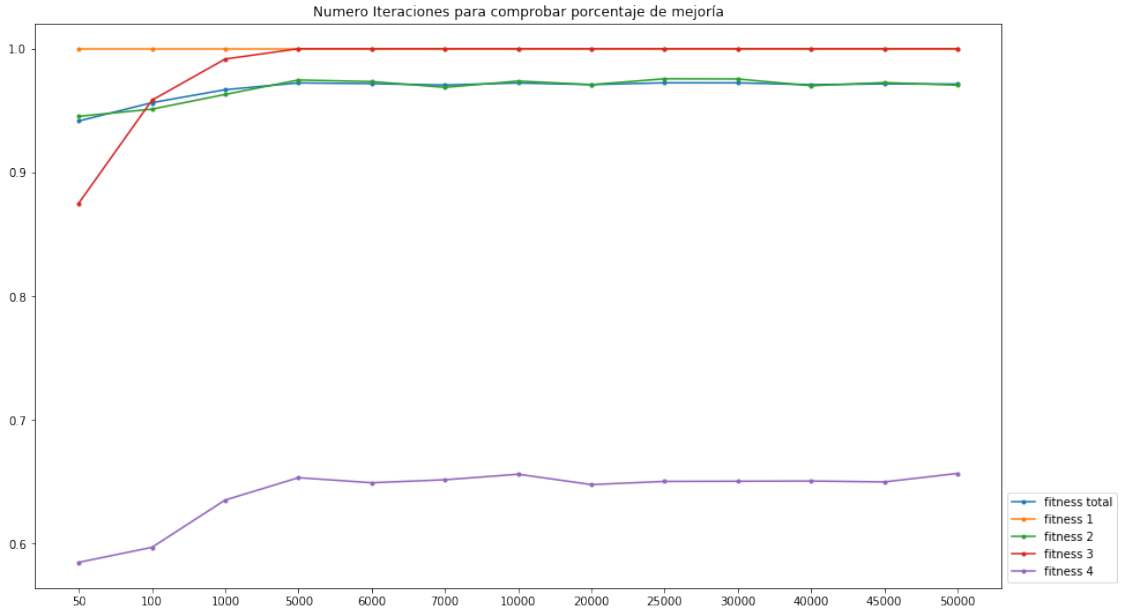
[20]:
```
base_path = BASE_URL + "4-NumCiclosPorcentajeMejoria"
sub_paths = get_subpaths(base_path, key=int)
parametro = "Numero Iteraciones para comprobar porcentaje de mejoría"
out_path = "4 " + parametro + "/"

ajuste_parametrico(base_path, sub_paths, out_path, parametro, {"ordenados":␣
 ↪False, "multiple": True})
```

```
['50', '100', '1000', '5000', '6000', '7000', '10000', '20000', '25000',
'30000', '40000', '45000', '50000']
```

	iteracion	tiempo (ms)	fitness total	fitness 1	fitness 2	fitness 3	\
50	401.0	4263.50	0.941558	1.0	0.945312	0.875000	
100	711.0	7373.10	0.956358	1.0	0.951129	0.958333	
1000	5501.0	53193.10	0.966867	1.0	0.963035	0.991667	
7000	21701.0	179395.40	0.970646	1.0	0.968755	1.000000	
40000	80001.0	568982.10	0.970942	1.0	0.970073	1.000000	
20000	40001.0	303861.20	0.971006	1.0	0.970950	1.000000	
50000	100001.0	600097.10	0.971440	1.0	0.970558	1.000000	
45000	90001.0	600035.90	0.971584	1.0	0.972614	1.000000	
6000	16201.0	137865.00	0.971767	1.0	0.973441	1.000000	
10000	27001.0	218714.55	0.972295	1.0	0.973865	1.000000	
5000	17501.0	151138.40	0.972355	1.0	0.974709	1.000000	

```
30000    60001.0    440762.70       0.972407        1.0   0.975539   1.000000
25000    50001.0    371645.90       0.972440        1.0   0.975696   1.000000

       fitness 4  tamaño  porcentajeMejora  mejor fitness  distancia  \
50      0.584562    24.0          0.011709       0.941558       -1.0
100     0.596721    24.0          0.010729       0.956358       -1.0
1000    0.634967    24.0          0.022877       0.966867       -1.0
7000    0.651363    24.0          0.005372       0.970646       -1.0
40000   0.650368    24.0          0.000000       0.970942       -1.0
20000   0.647494    24.0          0.003979       0.971006       -1.0
50000   0.656485    24.0          0.000000       0.971440       -1.0
45000   0.649632    24.0          0.000000       0.971584       -1.0
6000    0.648968    24.0          0.009285       0.971767       -1.0
10000   0.655859    24.0          0.007423       0.972295       -1.0
5000    0.653058    24.0          0.011054       0.972355       -1.0
30000   0.650184    24.0          0.000000       0.972407       -1.0
25000   0.650037    24.0          0.001769       0.972440       -1.0

       restricciones incumplidas  std. iteracion  std. tiempo (ms)  \
50                     23.625000      115.470054       1192.714854
100                    21.112222      137.032032       1402.028011
1000                   15.968889     1269.295518      12736.539740
7000                   13.497778     6129.165250      48672.440443
40000                  12.928333        0.000000      15996.193863
20000                  12.549444        0.000000       8786.200858
50000                  12.718889        0.000000         12.818823
45000                  11.830556        0.000000         16.037803
6000                   11.473333     4049.691346      33808.894661
10000                  11.290278     6569.466853      49692.305333
5000                   10.925556     4249.182928      38678.309001
30000                  10.567222        0.000000      18456.839052
25000                  10.499444        0.000000      14593.700045

       std. fitness total  std. tamaño
50               0.010316          0.0
100              0.006447          0.0
1000             0.004913          0.0
7000             0.002337          0.0
40000            0.002068          0.0
20000            0.002218          0.0
50000            0.002384          0.0
45000            0.002988          0.0
6000             0.001887          0.0
10000            0.002323          0.0
5000             0.001579          0.0
30000            0.002382          0.0
25000            0.002390          0.0
```


Numero Iteraciones para comprobar porcentaje de mejoría
fitness total
fitness 1
fitness 2
fitness 3
fitness 4
50
100
1000
5000
6000
7000
10000
20000
25000
30000
40000
45000
50000


Numero Iteraciones para comprobar porcentaje de mejoría
fitness total
fitness 1
fitness 2
fitness 3
fitness 4
50
100
1000
5000
6000
7000
10000
20000
25000
30000
40000
45000
50000

5 Porcentaje mínimo de mejoría

[21]:
```
base_path = BASE_URL + "5-PorcentajeMinimoMejoria"
sub_paths = get_subpaths(base_path, key=float)
parametro = "Porcentaje mínimo de mejoría"
out_path = "5 " + parametro + "/"

ajuste_parametrico(base_path, sub_paths, out_path, parametro)
```

```
['0.0', '0.005', '0.008', '0.01', '0.015', '0.03', '0.035', '0.05', '0.08',
'0.1', '0.35', '0.5', '0.7']
```

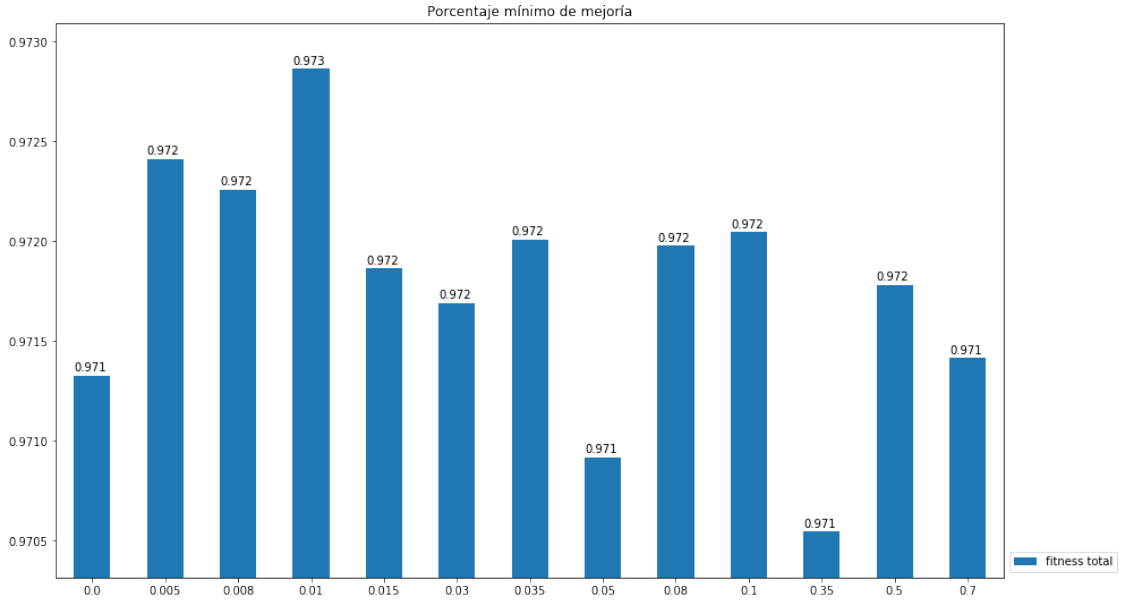
	iteracion	tiempo (ms)	fitness total	fitness 1	fitness 2	fitness 3	\
0.35	50001.0	373482.1	0.970547	1.0	0.968167	1.0	
0.05	50001.0	377199.8	0.970917	1.0	0.970103	1.0	
0.0	92501.0	251653.6	0.971327	1.0	0.969304	1.0	
0.7	50001.0	367778.4	0.971414	1.0	0.970669	1.0	
0.03	50001.0	372798.9	0.971690	1.0	0.970823	1.0	
0.5	50001.0	371365.5	0.971782	1.0	0.970328	1.0	
0.015	52501.0	388785.2	0.971865	1.0	0.971053	1.0	
0.08	50001.0	361286.7	0.971976	1.0	0.973045	1.0	
0.035	50001.0	364596.9	0.972009	1.0	0.971447	1.0	
0.1	50001.0	372813.1	0.972045	1.0	0.972719	1.0	
0.008	57501.0	416814.5	0.972258	1.0	0.973760	1.0	
0.005	50001.0	361710.2	0.972413	1.0	0.974155	1.0	
0.01	50001.0	360940.2	0.972863	1.0	0.975651	1.0	

	fitness 4	tamaño	porcentajeMejora	mejor fitness	distancia	\
0.35	0.652358	24.0	0.004257	0.970547	-1.0	
0.05	0.649816	24.0	0.002874	0.970917	-1.0	
0.0	0.660243	24.0	0.000000	0.971327	-1.0	
0.7	0.655564	24.0	0.000000	0.971414	-1.0	
0.03	0.659469	24.0	0.000884	0.971690	-1.0	
0.5	0.663228	24.0	0.004422	0.971782	-1.0	
0.015	0.661349	24.0	0.001105	0.971865	-1.0	
0.08	0.654237	24.0	0.000000	0.971976	-1.0	
0.035	0.661975	24.0	0.000000	0.972009	-1.0	
0.1	0.656853	24.0	0.002874	0.972045	-1.0	
0.008	0.655711	24.0	0.000000	0.972258	-1.0	
0.005	0.656522	24.0	0.000000	0.972413	-1.0	
0.01	0.657296	24.0	0.000221	0.972863	-1.0	

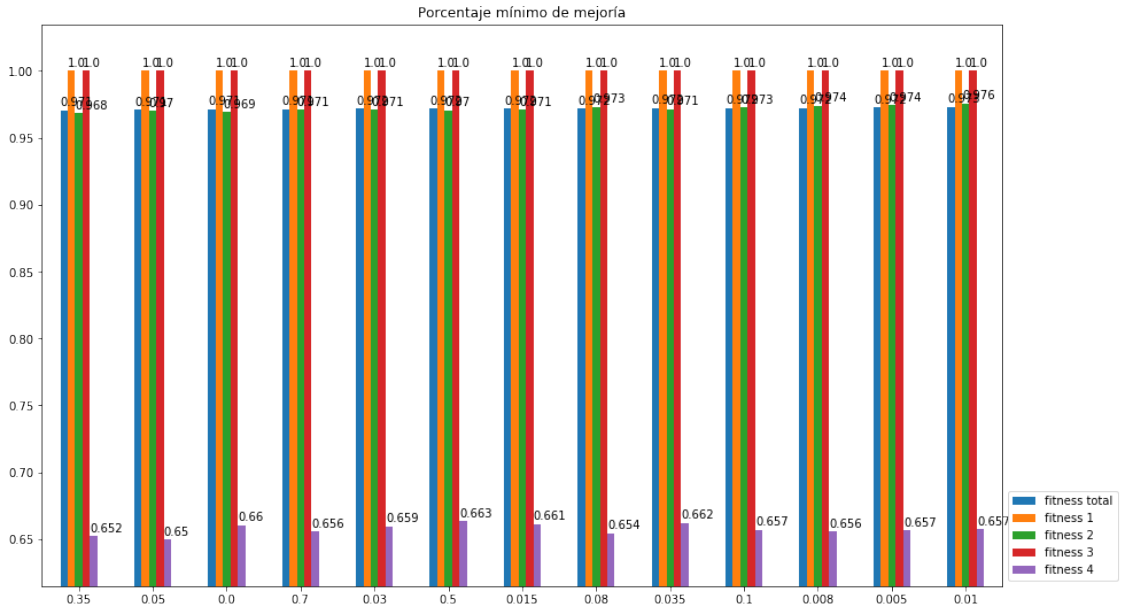
	restricciones incumplidas	std. iteracion	std. tiempo (ms)	\
0.35	13.751667	0.000000	14801.720984	
0.05	12.915556	0.000000	16986.834816	
0.0	13.260556	28987.545218	80037.566874	
0.7	12.671111	0.000000	10881.093748	
0.03	12.604444	0.000000	12173.406265	

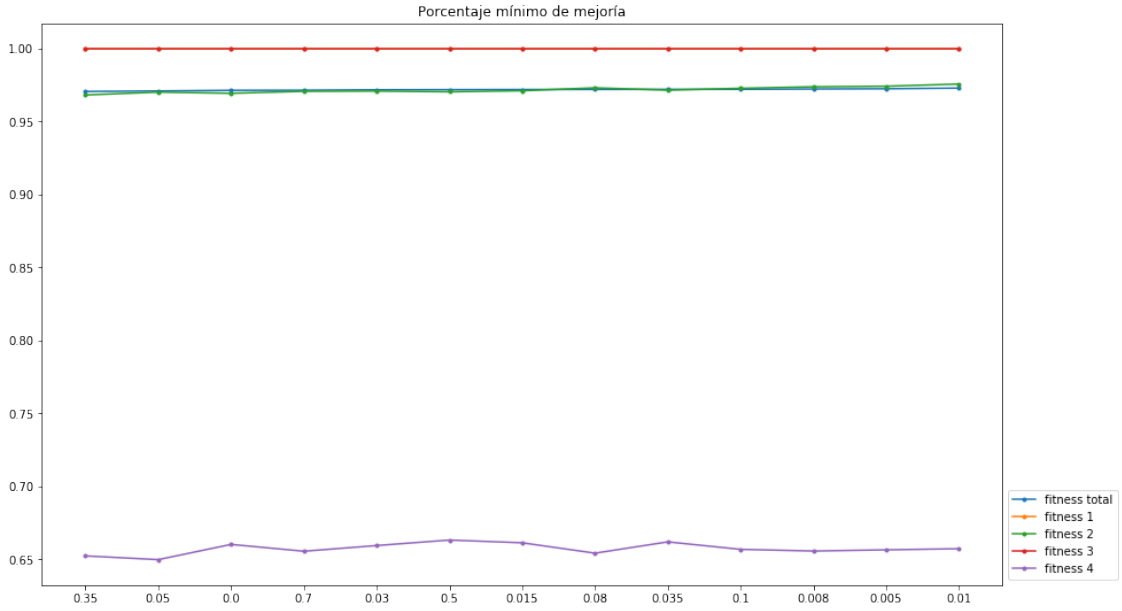
0.5	12.818333	0.000000	21169.949951
0.015	12.505000	7905.694150	58414.288811
0.08	11.644444	0.000000	17869.573147
0.035	12.335000	0.000000	6809.301326
0.1	11.785556	0.000000	16084.866479
0.008	11.335556	12076.147288	88572.809139
0.005	11.165000	0.000000	15277.690516
0.01	10.518889	0.000000	12344.939456

	std. fitness total	std. tamaño
0.35	0.001455	0.0
0.05	0.002140	0.0
0.0	0.002147	0.0
0.7	0.002139	0.0
0.03	0.002753	0.0
0.5	0.002453	0.0
0.015	0.002286	0.0
0.08	0.002261	0.0
0.035	0.001620	0.0
0.1	0.002916	0.0
0.008	0.001929	0.0
0.005	0.002345	0.0
0.01	0.001675	0.0




Porcentaje mínimo de mejoría
0.9725
0.9720
0.9715
0.9710
0.9705
0.0
0.005
0.008
0.01
0.015
0.03
0.035
0.05
0.08
0.1
0.35
0.5
0.7
fitness total


Porcentaje mínimo de mejoría
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.652
0.65
0.66
0.656
0.659
0.663
0.661
0.654
0.662
0.657
0.656
0.657
0.657
0.35
0.05
0.0
0.7
0.03
0.5
0.015
0.08
0.035
0.1
0.008
0.005
0.01
fitness total
fitness 1
fitness 2
fitness 3
fitness 4



6 Número máximo de iteraciones sin mejora en la Búsqueda Local

[22]:
```
base_path = BASE_URL + "6-NumMaxIteracionesSinMejoraBusquedaLocal__FIXED_LIMIT"
sub_paths = get_subpaths(base_path, key=int)
parametro = "Número máximo de iteraciones sin mejora en la Búsqueda Local"
out_path = "6 " + parametro + "/"

ajuste_parametrico(base_path, sub_paths, out_path, parametro)
```

```
['1', '2', '3', '4', '5', '6', '7', '8', '9', '10', '15', '20', '25', '30',
'40', '50', '60', '70', '80', '90', '100', '110', '120', '130', '140', '150',
'180', '200', '250']
```

	iteracion	tiempo (ms)	fitness total	fitness 1	fitness 2	fitness 3	\
200	50001.0	11148936.0	0.968159	1.0	0.957973	1.0	
5	50001.0	374447.0	0.969409	1.0	0.962603	1.0	
30	50001.0	1764069.0	0.969854	1.0	0.967361	1.0	
60	50001.0	3375454.0	0.970148	1.0	0.962230	1.0	
25	50001.0	1506424.0	0.970183	1.0	0.962359	1.0	
130	50001.0	7511078.0	0.970241	1.0	0.966911	1.0	
110	50001.0	6135875.0	0.970596	1.0	0.969290	1.0	
2	50001.0	197389.0	0.970886	1.0	0.967335	1.0	
80	50001.0	4505963.0	0.970891	1.0	0.971695	1.0	
140	50001.0	7806795.0	0.970964	1.0	0.974177	1.0	
6	50001.0	415765.0	0.971437	1.0	0.974537	1.0	
20	50001.0	1101661.0	0.971469	1.0	0.967040	1.0	

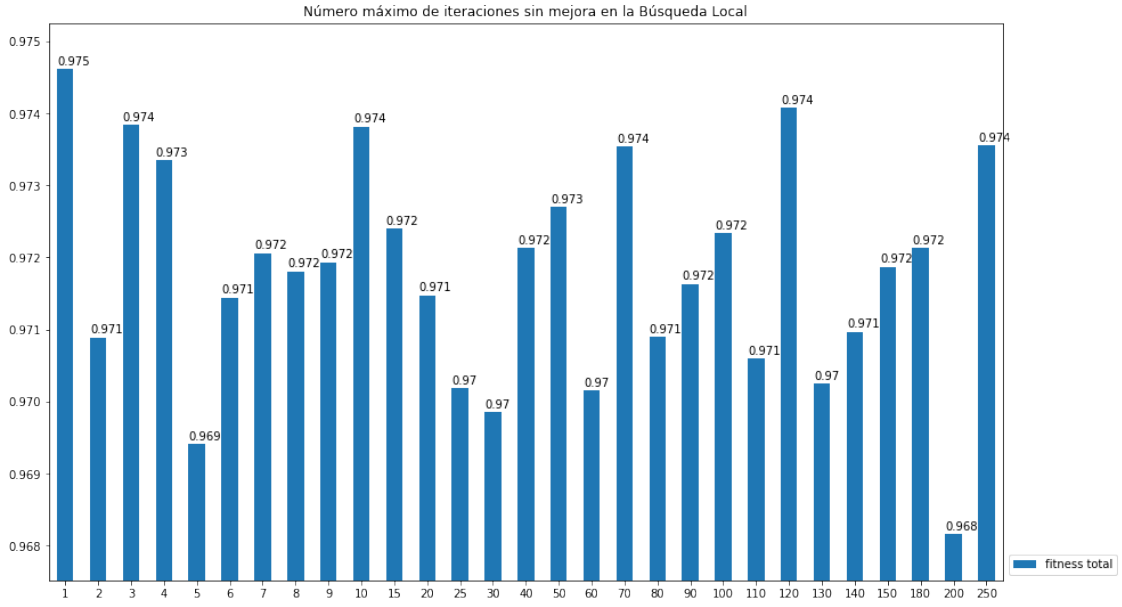
90	50001.0	5226007.0	0.971632	1.0	0.967233	1.0	
8	50001.0	501051.0	0.971805	1.0	0.969432	1.0	
150	50001.0	8378491.0	0.971869	1.0	0.971631	1.0	
9	50001.0	606695.0	0.971934	1.0	0.974164	1.0	
7	50001.0	472371.0	0.972058	1.0	0.976672	1.0	
180	50001.0	10334865.0	0.972124	1.0	0.969792	1.0	
40	50001.0	2190900.0	0.972125	1.0	0.973971	1.0	
100	50001.0	5379946.0	0.972337	1.0	0.972055	1.0	
15	50001.0	920301.0	0.972396	1.0	0.978498	1.0	
50	50001.0	2756570.0	0.972697	1.0	0.976826	1.0	
4	50001.0	318203.0	0.973350	1.0	0.976543	1.0	
70	50001.0	3738133.0	0.973535	1.0	0.976492	1.0	
250	50001.0	13926011.0	0.973553	1.0	0.974267	1.0	
10	50001.0	615980.0	0.973811	1.0	0.976286	1.0	
3	75001.0	366848.0	0.973841	1.0	0.978935	1.0	
120	50001.0	6455867.0	0.974072	1.0	0.981430	1.0	
1	75001.0	194768.0	0.974611	1.0	0.979167	1.0	

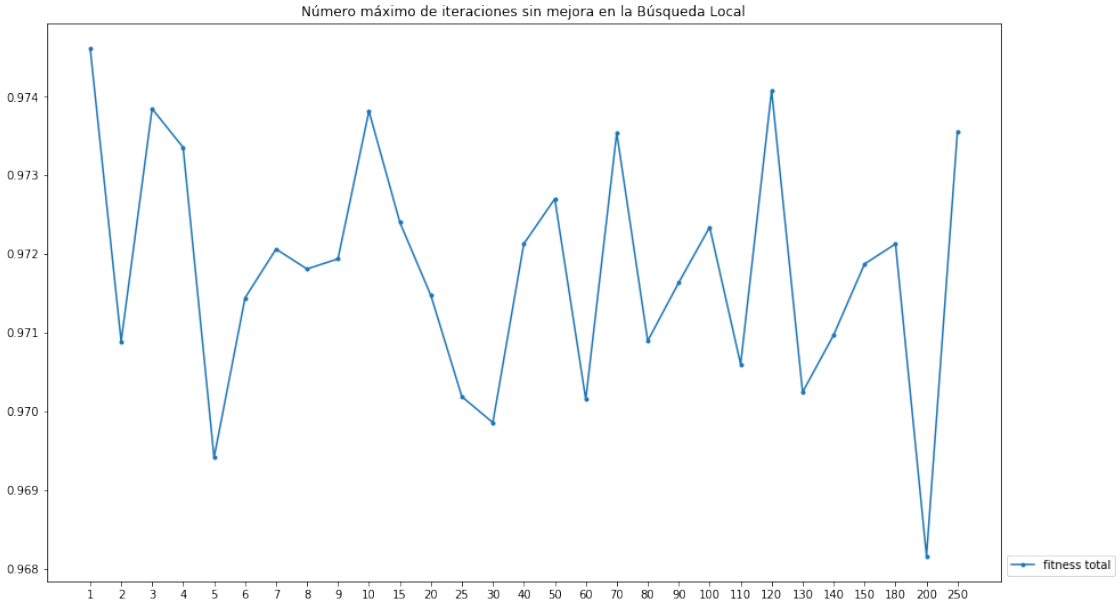
	fitness 4	tamaño	porcentajeMejora	mejor fitness	distancia	\
200	0.658438	24.0	0.000000	0.968159	-1.0	
5	0.658438	24.0	0.000000	0.969409	-1.0	
30	0.644436	24.0	0.000000	0.969854	-1.0	
60	0.672439	24.0	0.000000	0.970148	-1.0	
25	0.672439	24.0	0.000000	0.970183	-1.0	
130	0.652911	24.0	0.000000	0.970241	-1.0	
110	0.648121	24.0	0.000000	0.970596	-1.0	
2	0.661754	24.0	0.006632	0.970886	-1.0	
80	0.642225	24.0	0.000000	0.970891	-1.0	
140	0.632277	24.0	0.000000	0.970964	-1.0	
6	0.638541	24.0	0.000000	0.971437	-1.0	
20	0.672808	24.0	0.000000	0.971469	-1.0	
90	0.674650	24.0	0.000000	0.971632	-1.0	
8	0.667649	24.0	0.000000	0.971805	-1.0	
150	0.658806	24.0	0.000000	0.971869	-1.0	
9	0.648489	24.0	0.000000	0.971934	-1.0	
7	0.639278	24.0	0.000000	0.972058	-1.0	
180	0.671334	24.0	0.000000	0.972124	-1.0	
40	0.652542	24.0	0.000000	0.972125	-1.0	
100	0.664702	24.0	0.000000	0.972337	-1.0	
15	0.636699	24.0	0.000000	0.972396	-1.0	
50	0.649226	24.0	0.000000	0.972697	-1.0	
4	0.661385	24.0	0.000000	0.973350	-1.0	
70	0.664702	24.0	0.000000	0.973535	-1.0	
250	0.675018	24.0	0.000000	0.973553	-1.0	
10	0.670228	24.0	0.000000	0.973811	-1.0	
3	0.658806	24.0	0.000000	0.973841	-1.0	
120	0.651437	24.0	0.000000	0.974072	-1.0	
1	0.670597	24.0	0.000000	0.974611	-1.0	

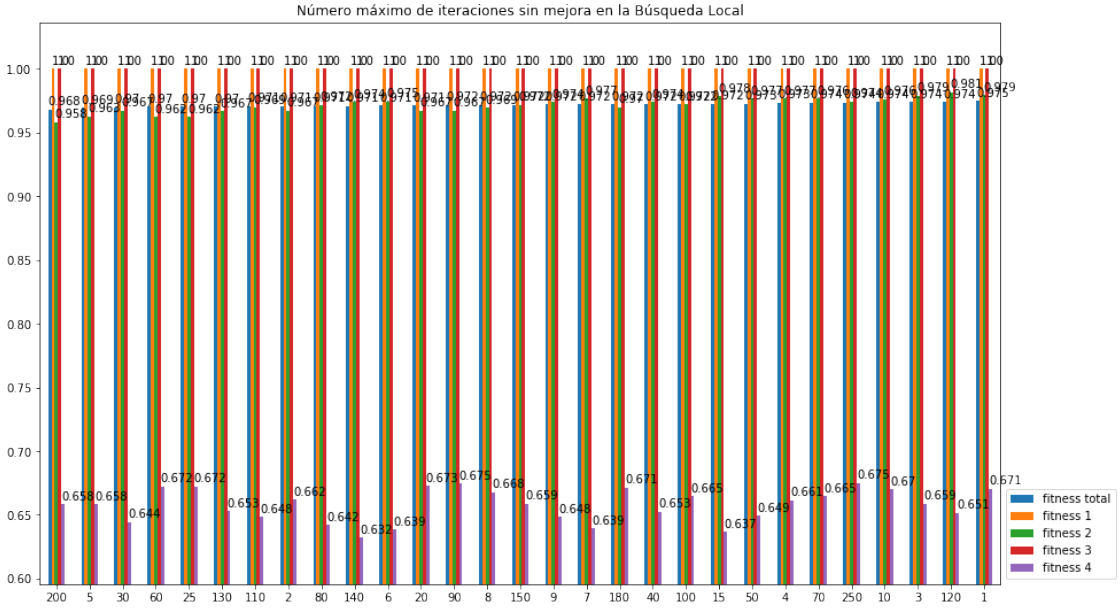
	restricciones incumplidas	std. iteracion	std. tiempo (ms)	\
200	18.155556	NaN	NaN	
5	16.155556	NaN	NaN	
30	14.100000	NaN	NaN	
60	16.316667	NaN	NaN	
25	16.261111	NaN	NaN	
130	14.294444	NaN	NaN	
110	13.266667	NaN	NaN	
2	14.111111	NaN	NaN	
80	12.227778	NaN	NaN	
140	11.155556	NaN	NaN	
6	11.000000	NaN	NaN	
20	14.238889	NaN	NaN	
90	14.155556	NaN	NaN	
8	13.205556	NaN	NaN	
150	12.255556	NaN	NaN	
9	11.161111	NaN	NaN	
7	10.077778	NaN	NaN	
180	13.050000	NaN	NaN	
40	11.244444	NaN	NaN	
100	12.072222	NaN	NaN	
15	9.288889	NaN	NaN	
50	10.011111	NaN	NaN	
4	10.133333	NaN	NaN	
70	10.155556	NaN	NaN	
250	11.116667	NaN	NaN	
10	10.244444	NaN	NaN	
3	9.100000	NaN	NaN	
120	8.022222	NaN	NaN	
1	9.000000	NaN	NaN	

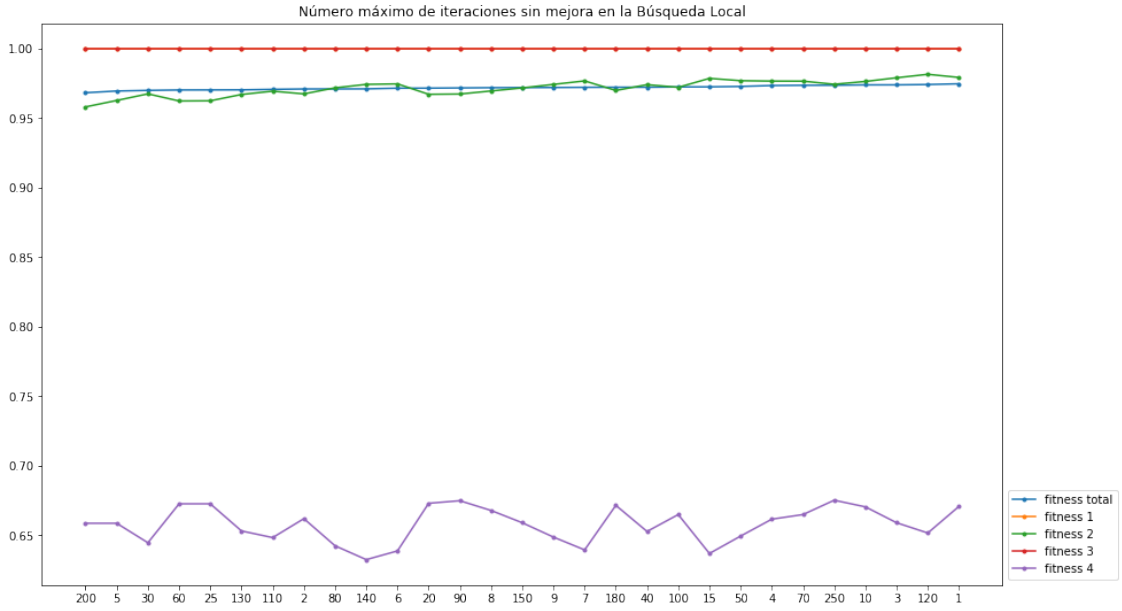
	std. fitness total	std. tamaño
200	NaN	NaN
5	NaN	NaN
30	NaN	NaN
60	NaN	NaN
25	NaN	NaN
130	NaN	NaN
110	NaN	NaN
2	NaN	NaN
80	NaN	NaN
140	NaN	NaN
6	NaN	NaN
20	NaN	NaN
90	NaN	NaN
8	NaN	NaN
150	NaN	NaN

9	NaN	NaN
7	NaN	NaN
180	NaN	NaN
40	NaN	NaN
100	NaN	NaN
15	NaN	NaN
50	NaN	NaN
4	NaN	NaN
70	NaN	NaN
250	NaN	NaN
10	NaN	NaN
3	NaN	NaN
120	NaN	NaN
1	NaN	NaN




Número máximo de iteraciones sin mejora en la Búsqueda Local
fitness total


Número máximo de iteraciones sin mejora en la Búsqueda Local
fitness total
fitness 1
fitness 2
fitness 3
fitness 4



7 Porcentaje mínimo de mejoría en la Búsqueda Local

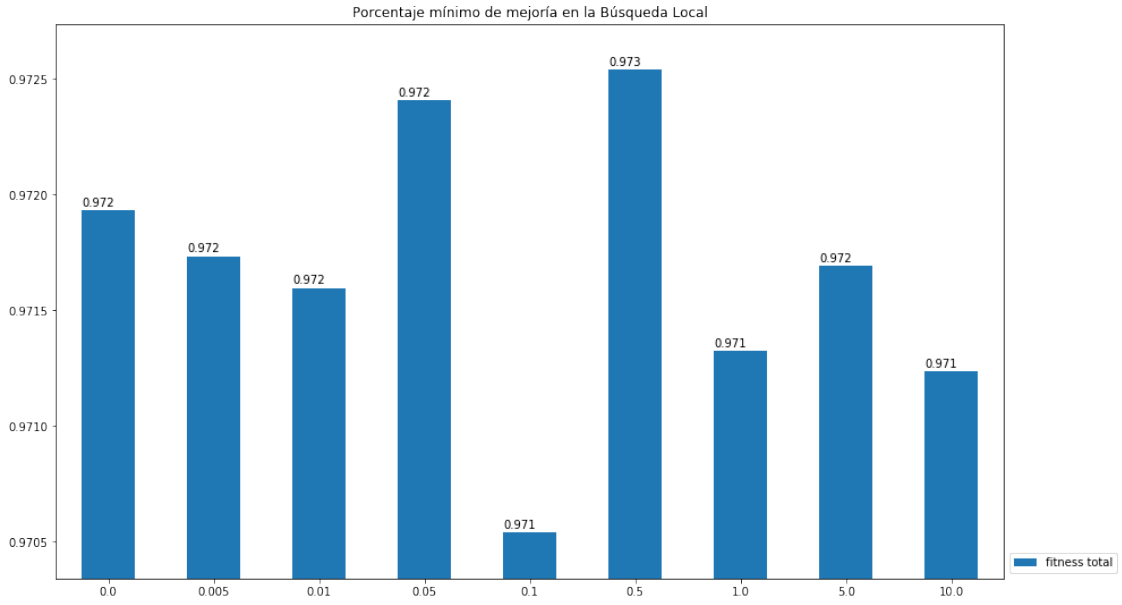
[23]:
```
base_path = BASE_URL + "7-PorcentajeMinimoMejoriaBusquedaLocal"
sub_paths = get_subpaths(base_path, key=float)
parametro = "Porcentaje mínimo de mejoría en la Búsqueda Local"
out_path = "7 " + parametro + "/"

ajuste_parametrico(base_path, sub_paths, out_path, parametro)
```

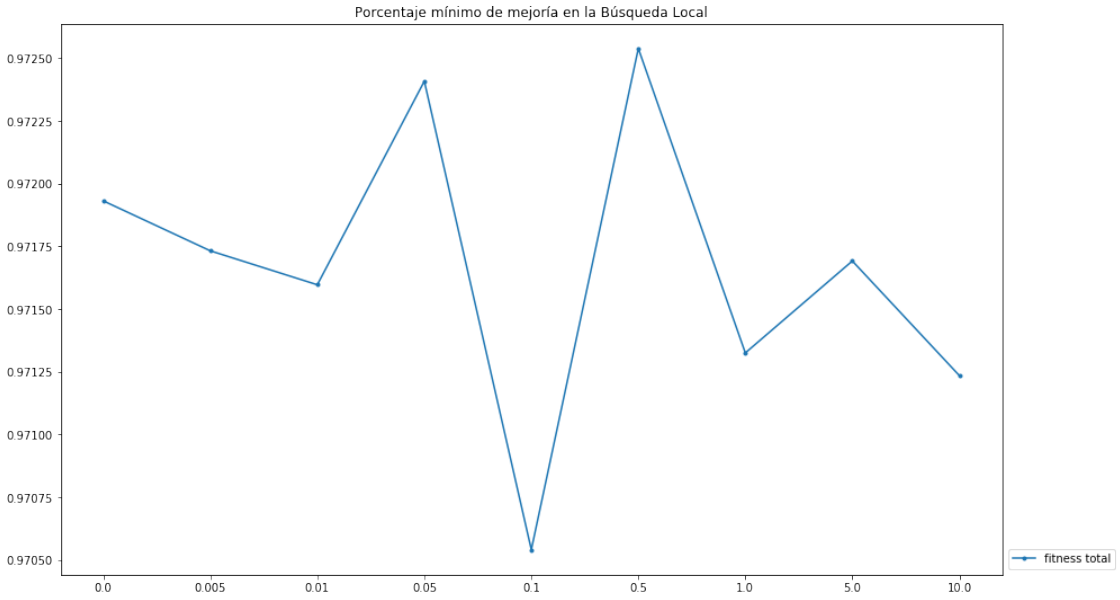
```
['0.0', '0.005', '0.01', '0.05', '0.1', '0.5', '1.0', '5.0', '10.0']

       iteracion  tiempo (ms)  fitness total  fitness 1  fitness 2  fitness 3  \
0.1      75001.0     208476.6       0.970541        1.0   0.968957        1.0
10.0     77501.0     215262.6       0.971235        1.0   0.971256        1.0
1.0      80001.0     220496.4       0.971325        1.0   0.971328        1.0
0.01     85001.0     236612.1       0.971597        1.0   0.971507        1.0
5.0      72501.0     199399.5       0.971691        1.0   0.970426        1.0
0.005    72501.0     200456.2       0.971732        1.0   0.972753        1.0
0.0      82501.0     226294.6       0.971931        1.0   0.972549        1.0
0.05     90001.0     248481.8       0.972408        1.0   0.974823        1.0
0.5      80001.0     215265.5       0.972538        1.0   0.975158        1.0

       fitness 4  tamaño  porcentajeMejora  mejor fitness  distancia  \
0.1     0.648710    24.0          0.001105       0.970541       -1.0
10.0    0.649926    24.0          0.000221       0.971235       -1.0
1.0     0.651105    24.0          0.001882       0.971325       -1.0
```

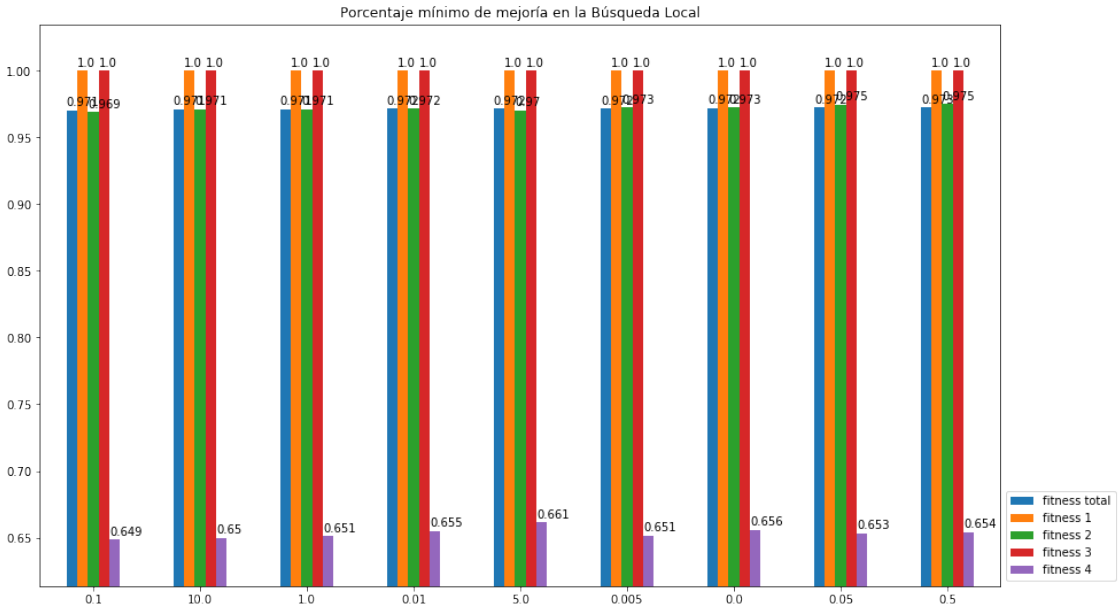
```
0.01    0.654827    24.0          0.002874       0.971597       -1.0
5.0     0.661275    24.0          0.002211       0.971691       -1.0
0.005   0.651474    24.0          0.003095       0.971732       -1.0
0.0     0.655711    24.0          0.001769       0.971931       -1.0
0.05    0.653427    24.0          0.002081       0.972408       -1.0
0.5     0.654090    24.0          0.001769       0.972538       -1.0
```

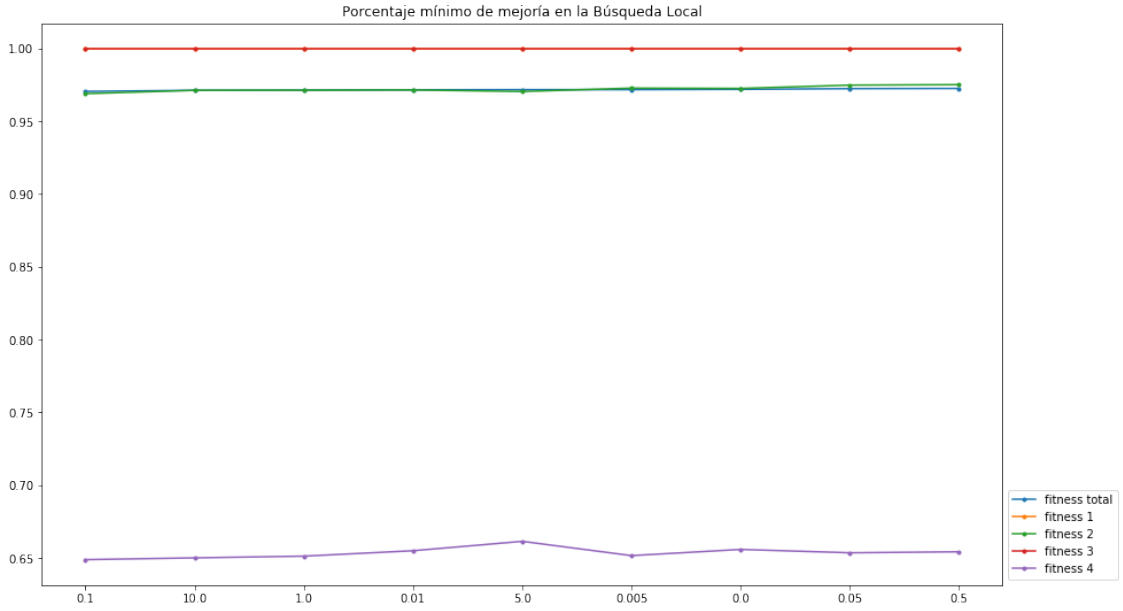
	restricciones incumplidas	std. iteracion	std. tiempo (ms)	\
0.1	13.410556	11785.113020	30602.294613	
10.0	12.417222	14191.155305	38888.606781	
1.0	12.386111	19720.265944	50069.827970	
0.01	12.308889	17480.147470	51715.706444	
5.0	12.776111	14191.155305	40192.812523	
0.005	11.770556	7905.694150	22792.113796	
0.0	11.858889	12076.147288	32740.617167	
0.05	10.876667	41163.630117	113935.633433	
0.5	10.731667	15811.388301	41158.654697	

	std. fitness total	std. tamaño
0.1	0.001744	0.0
10.0	0.002094	0.0
1.0	0.002263	0.0
0.01	0.001796	0.0
5.0	0.002078	0.0
0.005	0.002009	0.0
0.0	0.001613	0.0
0.05	0.002400	0.0
0.5	0.002580	0.0




Porcentaje mínimo de mejoría en la Búsqueda Local
0.97250
0.97225
0.97200
0.97175
0.97150
0.97125
0.97100
0.97075
0.97050
0.0
0.005
0.01
0.05
0.1
0.5
1.0
5.0
10.0
fitness total


Porcentaje mínimo de mejoría en la Búsqueda Local
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.649
0.65
0.651
0.655
0.661
0.651
0.656
0.653
0.654
0.1
10.0
1.0
0.01
5.0
0.005
0.0
0.05
0.5
fitness total
fitness 1
fitness 2
fitness 3
fitness 4


Porcentaje mínimo de mejoría en la Búsqueda Local
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.1
10.0
1.0
0.01
5.0
0.005
0.0
0.05
0.5
fitness total
fitness 1
fitness 2
fitness 3
fitness 4

[ ]: