

Caso 1

Hacemos las importaciones pertinentes y ajustamos el tamaño de las gráficas
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

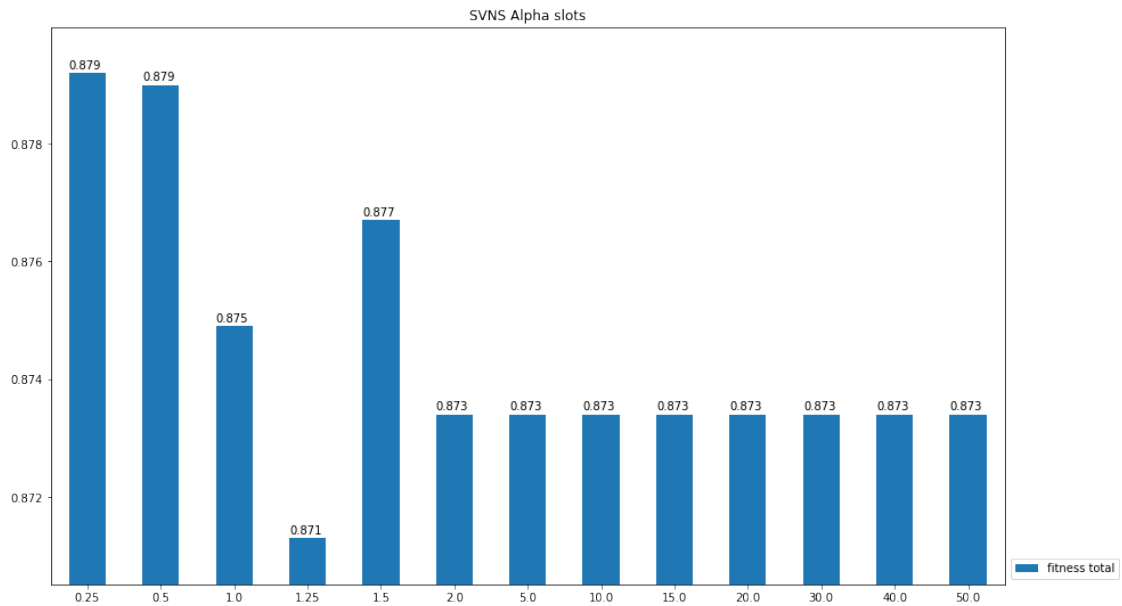
Empezamos el ajuste con el tipo de VNS. Para ello probamos diferentes valores para alpha y la funcion de distancia cuando ejecutemos el SVNS

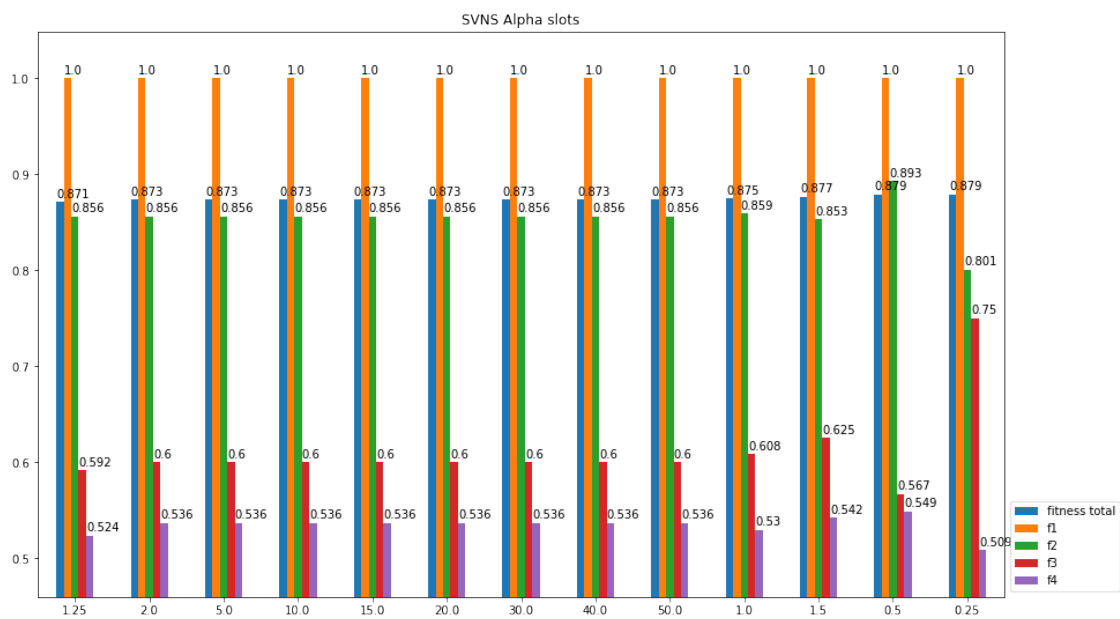
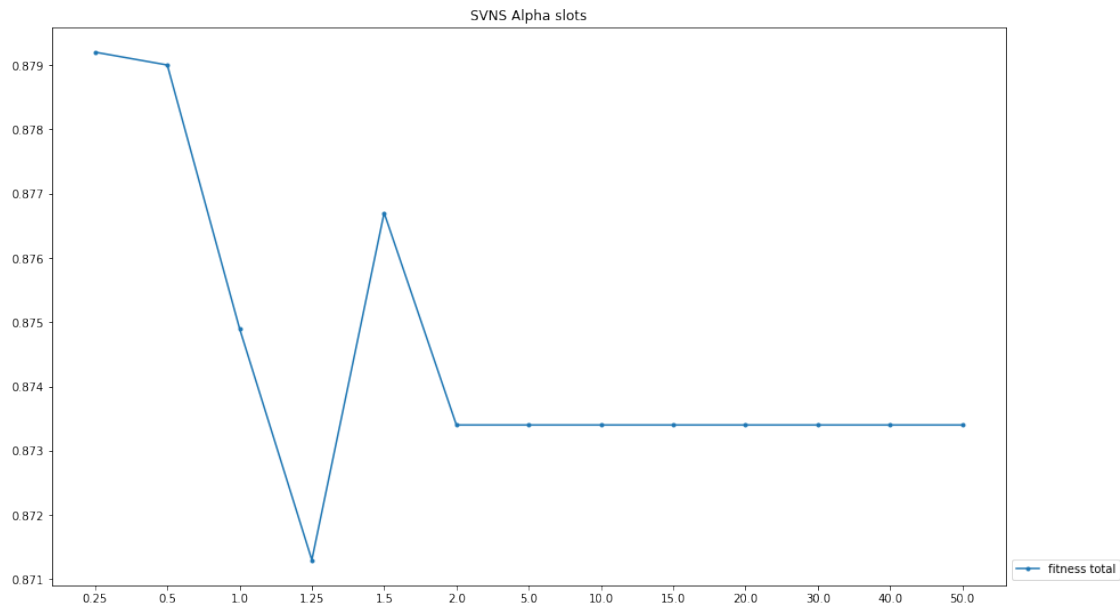
1.1 Alpha y función de distancia

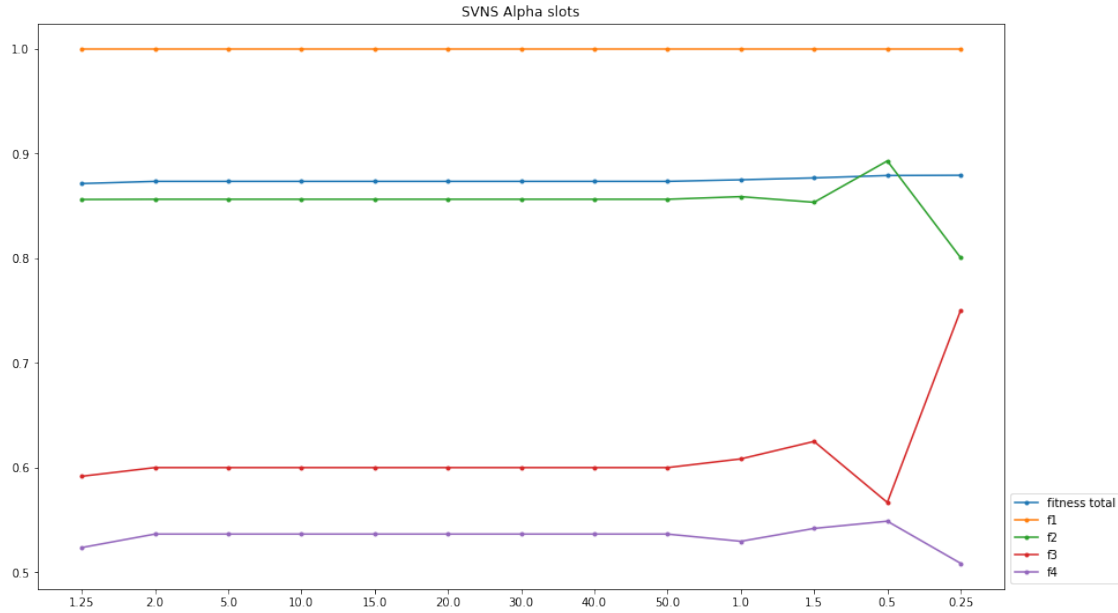
Para poder ajustar el alpha tenemos dos posibilidades, empleando como función de distancia el número de slots y empleando la diferencia del valor de los fitness

1.1.1 Funcion de distancia: Número de Slots

	iteracion	tiempo (ms)	fitness total	f1	f2	f3	f4	restricciones
1.25	5001.0	82811.0	0.8713	1.0	0.8561	0.5917	0.5236	62.1722
2.0	5001.0	84005.0	0.8734	1.0	0.8563	0.6000	0.5365	62.0633
5.0	5001.0	83974.0	0.8734	1.0	0.8563	0.6000	0.5365	62.0633
10.0	5001.0	84027.2	0.8734	1.0	0.8563	0.6000	0.5365	62.0633
15.0	5001.0	83858.2	0.8734	1.0	0.8563	0.6000	0.5365	62.0633
20.0	5001.0	83902.0	0.8734	1.0	0.8563	0.6000	0.5365	62.0633
30.0	5001.0	84049.0	0.8734	1.0	0.8563	0.6000	0.5365	62.0633
40.0	5001.0	83967.8	0.8734	1.0	0.8563	0.6000	0.5365	62.0633
50.0	5001.0	83880.4	0.8734	1.0	0.8563	0.6000	0.5365	62.0633
1.0	5001.0	84330.2	0.8749	1.0	0.8588	0.6083	0.5296	60.9856
1.5	5001.0	84330.6	0.8767	1.0	0.8534	0.6250	0.5419	63.3422
0.5	5001.0	87101.4	0.8790	1.0	0.8929	0.5667	0.5488	46.2556
0.25	5001.0	83918.6	0.8792	1.0	0.8006	0.7500	0.5086	86.1411



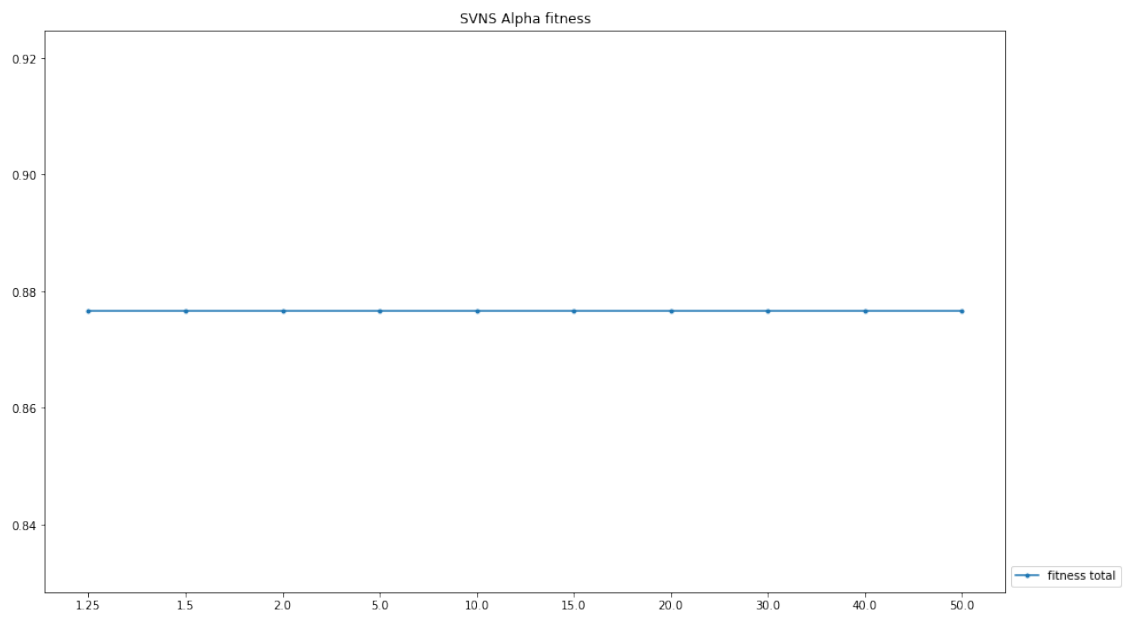
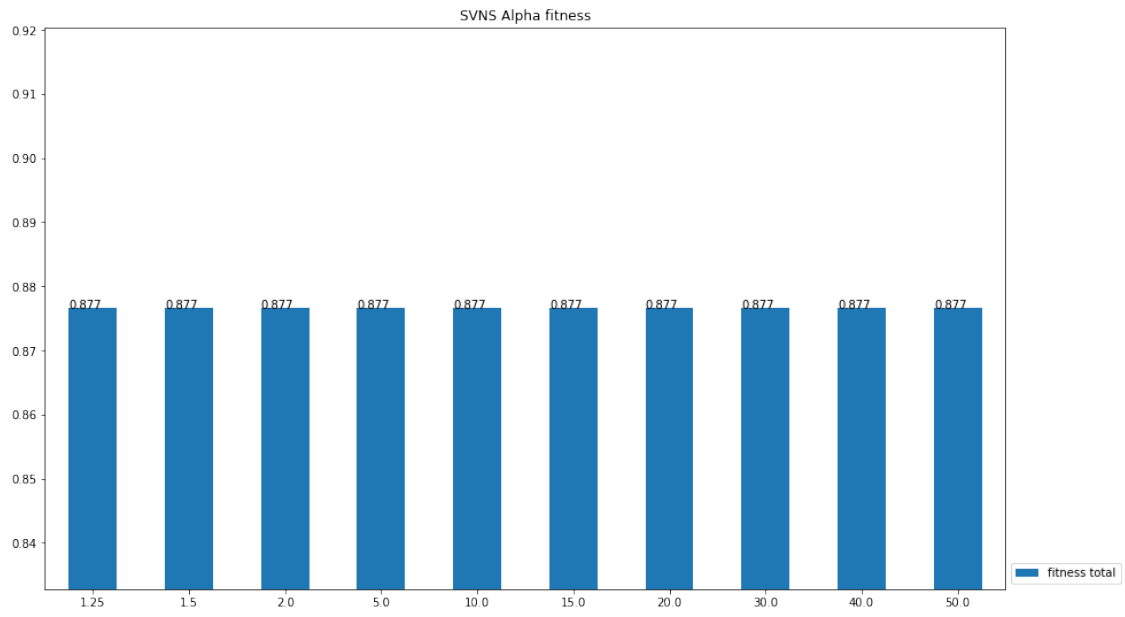


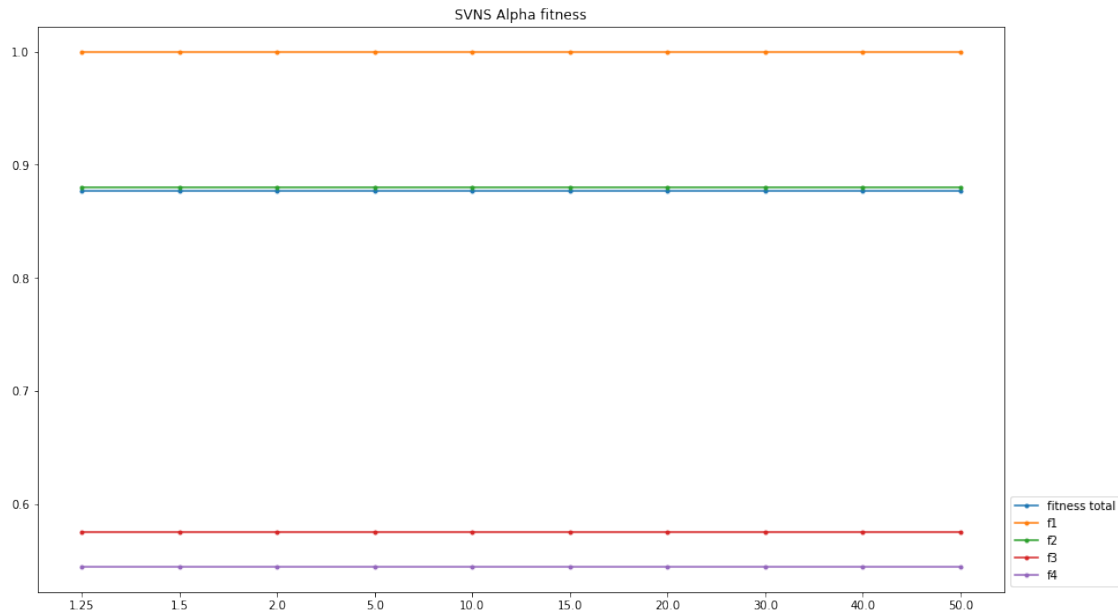
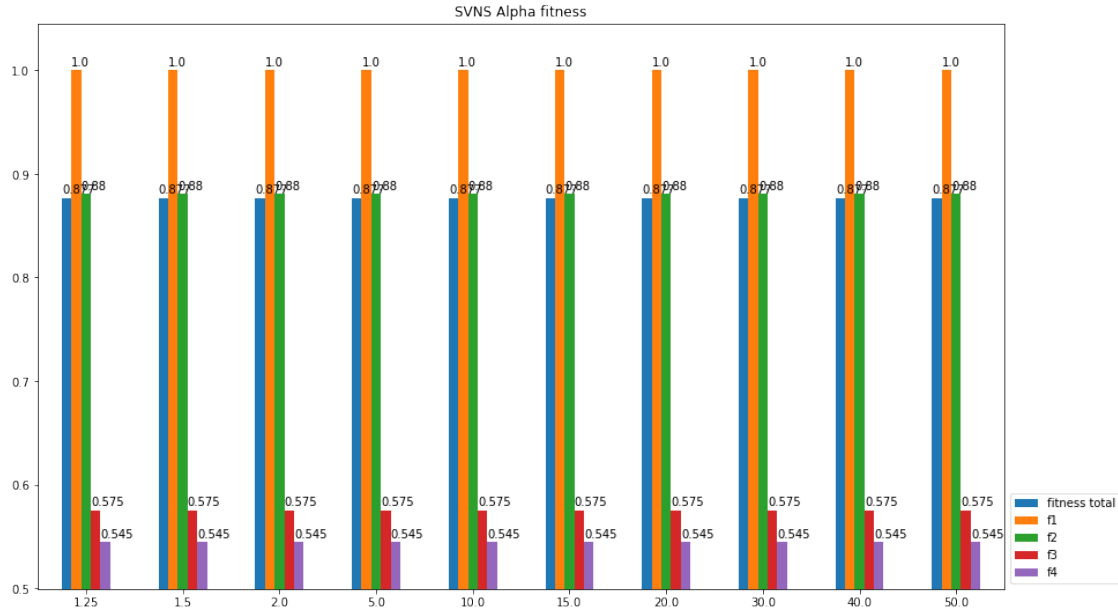


1.1.2 Función de distancia: Fitness

	iteracion	tiempo (ms)	fitness total	f1	f2	f3	f4	restricciones
1.25	5001.0	85551.6	0.8766	1.0	0.8804	0.575	0.5447	51.6722
1.5	5001.0	84983.8	0.8766	1.0	0.8804	0.575	0.5447	51.6722
2.0	5001.0	84623.6	0.8766	1.0	0.8804	0.575	0.5447	51.6722
5.0	5001.0	84399.6	0.8766	1.0	0.8804	0.575	0.5447	51.6722
10.0	5001.0	84431.2	0.8766	1.0	0.8804	0.575	0.5447	51.6722
15.0	5001.0	84444.0	0.8766	1.0	0.8804	0.575	0.5447	51.6722
20.0	5001.0	85600.0	0.8766	1.0	0.8804	0.575	0.5447	51.6722
30.0	5001.0	84986.2	0.8766	1.0	0.8804	0.575	0.5447	51.6722
40.0	5001.0	84964.8	0.8766	1.0	0.8804	0.575	0.5447	51.6722
50.0	5001.0	84784.6	0.8766	1.0	0.8804	0.575	0.5447	51.6722

C:\Users\GL753V\Documents\Projects\TFM-graficador\ajuste-parametrico\ajuste-parametrico.py:81: UserWarning: Attempting to set identical bottom == top == 0.8766 results in singular transformations; automatically expanding.
plt.ylim([low - 0.1 * (high - low), high + 0.1 * (high - low)])





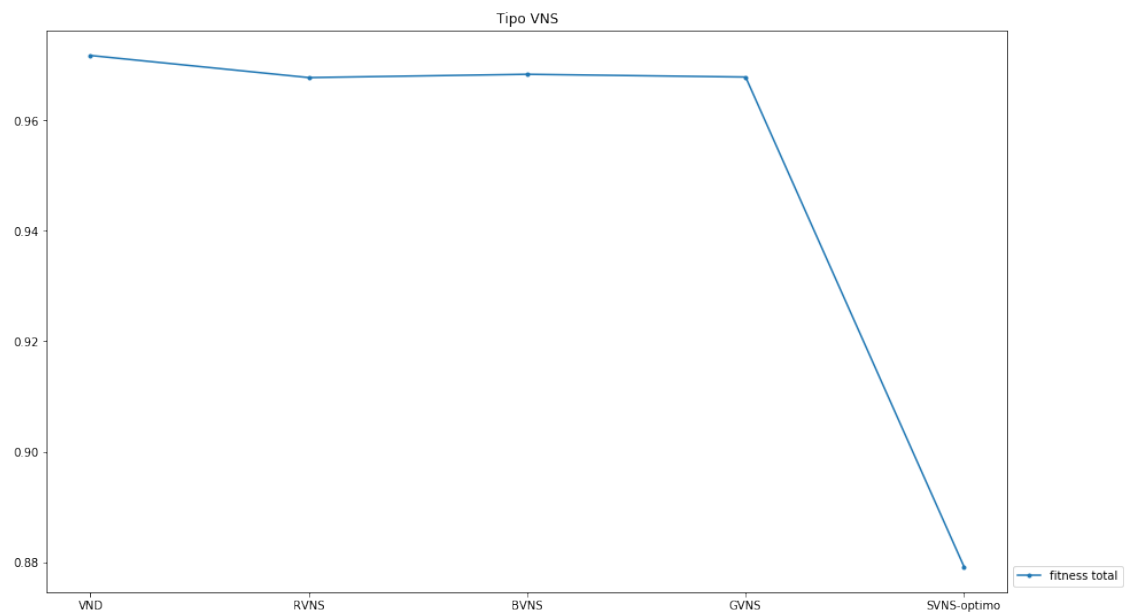
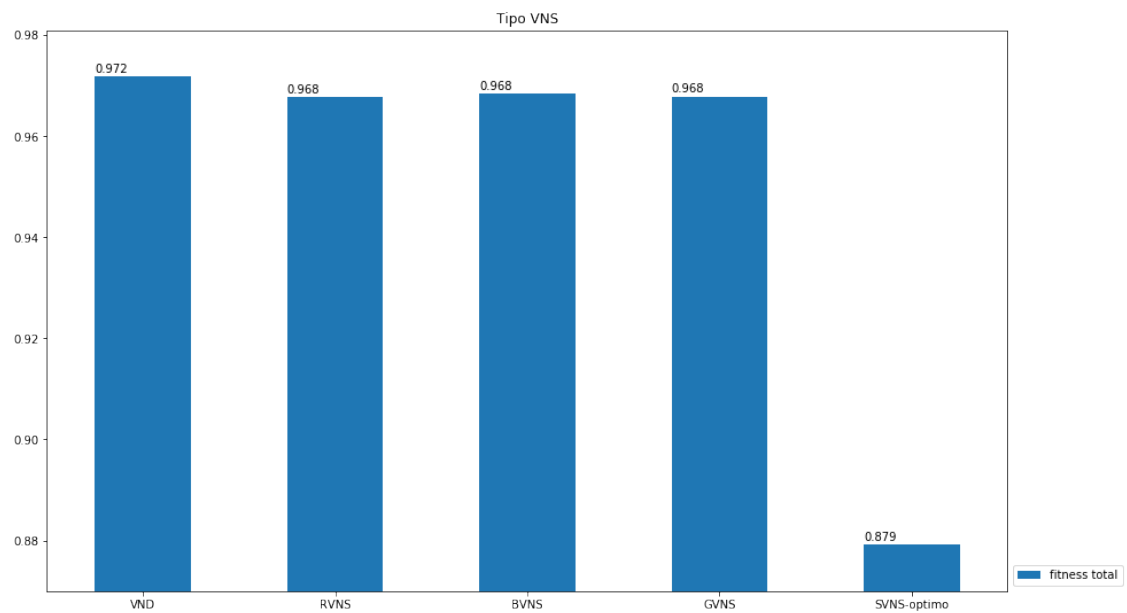
En vista de los resultados anteriores, podemos decir que los resultados son mejores empleando como función de distancia el número de slots diferentes ponderado, con un apha de 0.25

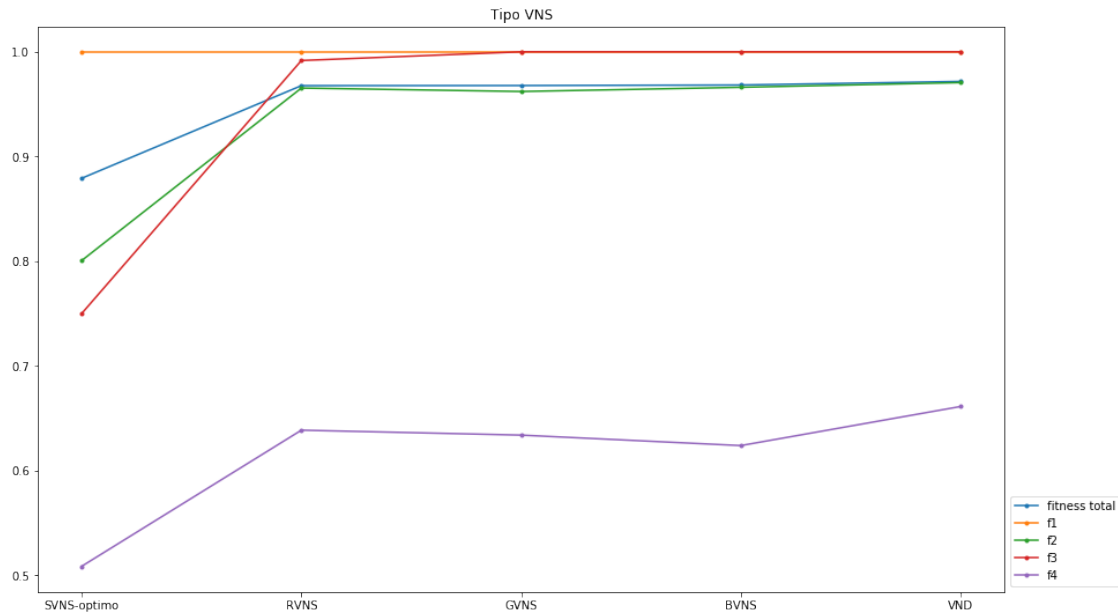
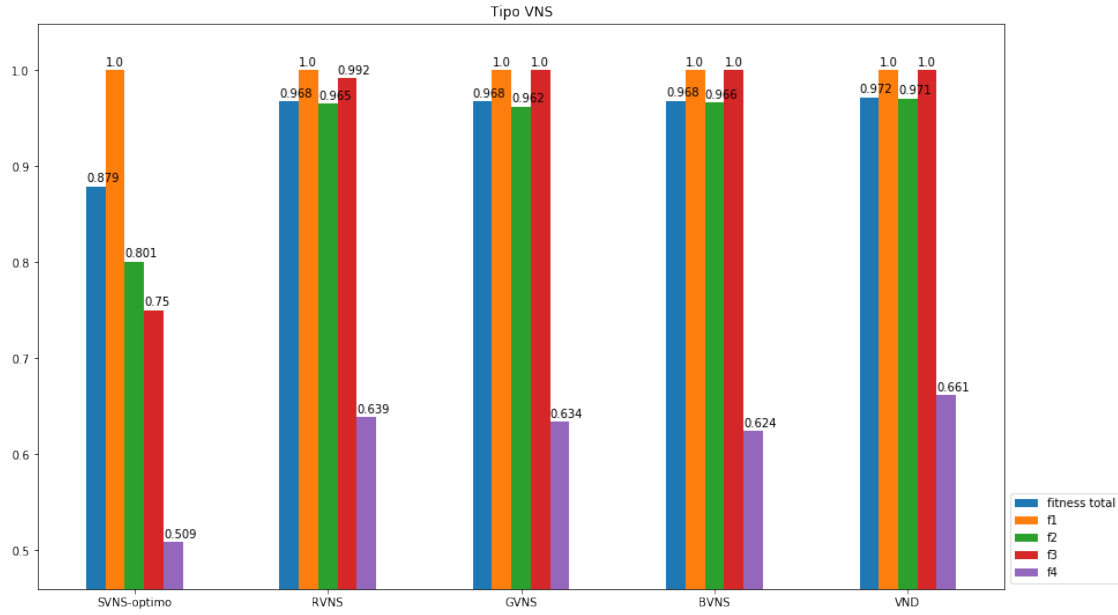
$$\alpha = 0.25$$

$$FunciónDistancia = \Delta slots$$

1.2 Tipo de VNS

	iteracion	tiempo (ms)	fitness total	f1	f2	f3	f4
SVNS-optimo	5001.0	83918.6	0.8792	1.0	0.8006	0.7500	0.5086
RVNS	31001.0	51945.0	0.9677	1.0	0.9654	0.9917	0.6386
GVNS	31001.0	371246.6	0.9678	1.0	0.9621	1.0000	0.6339
BVNS	31501.0	372375.4	0.9683	1.0	0.9661	1.0000	0.6239
VND	16501.0	141246.7	0.9717	1.0	0.9706	1.0000	0.6612





Podemos observar que los resultados del SVNS son muy bajos en comparación con los demás, 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.

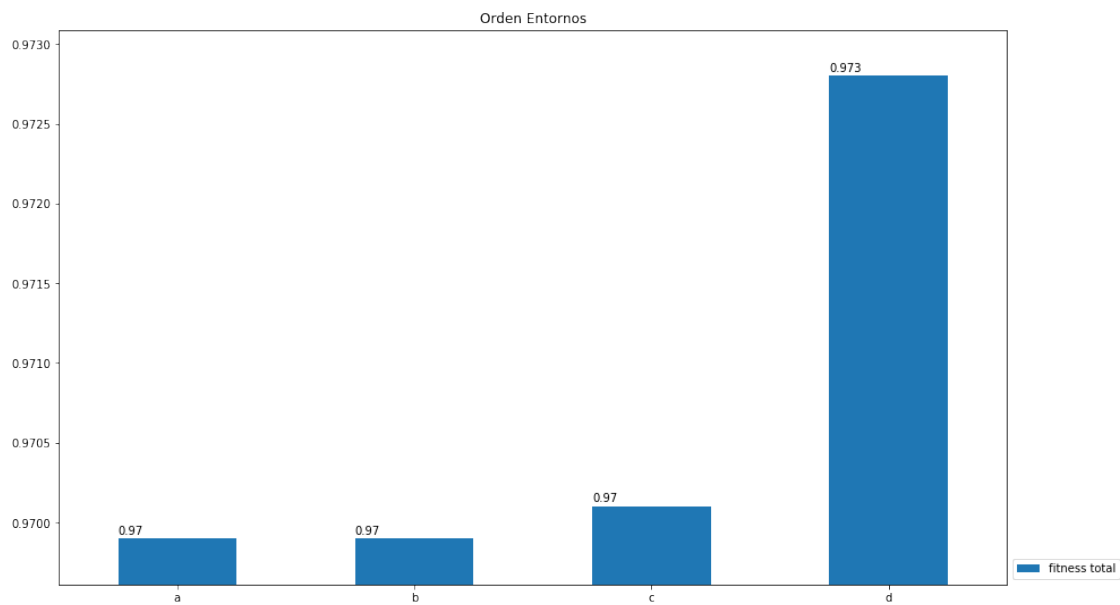
$$TipoVNS = VND$$

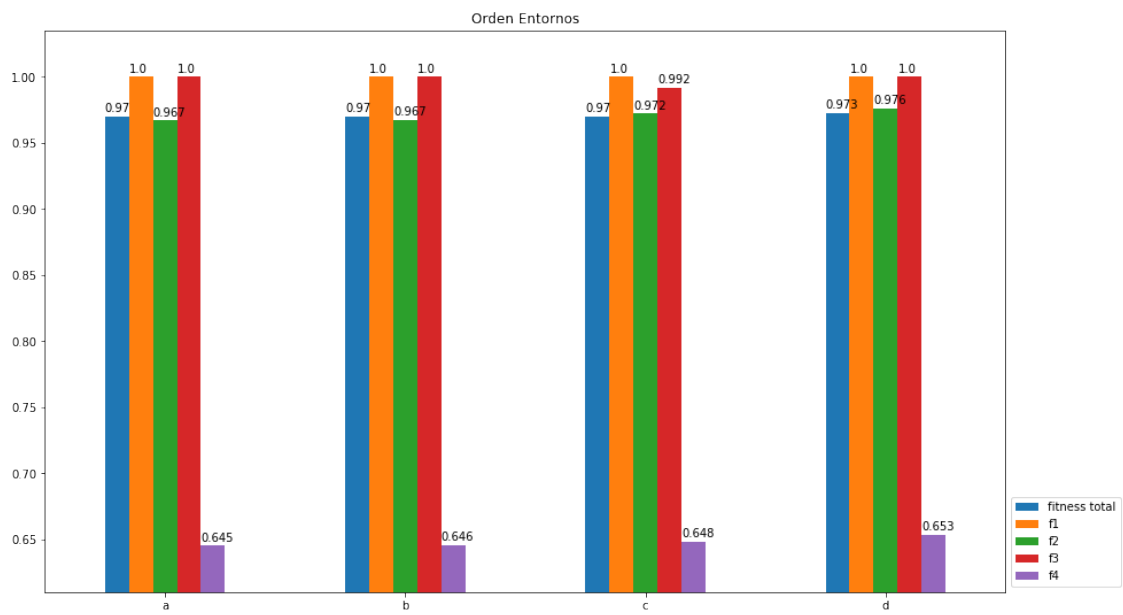
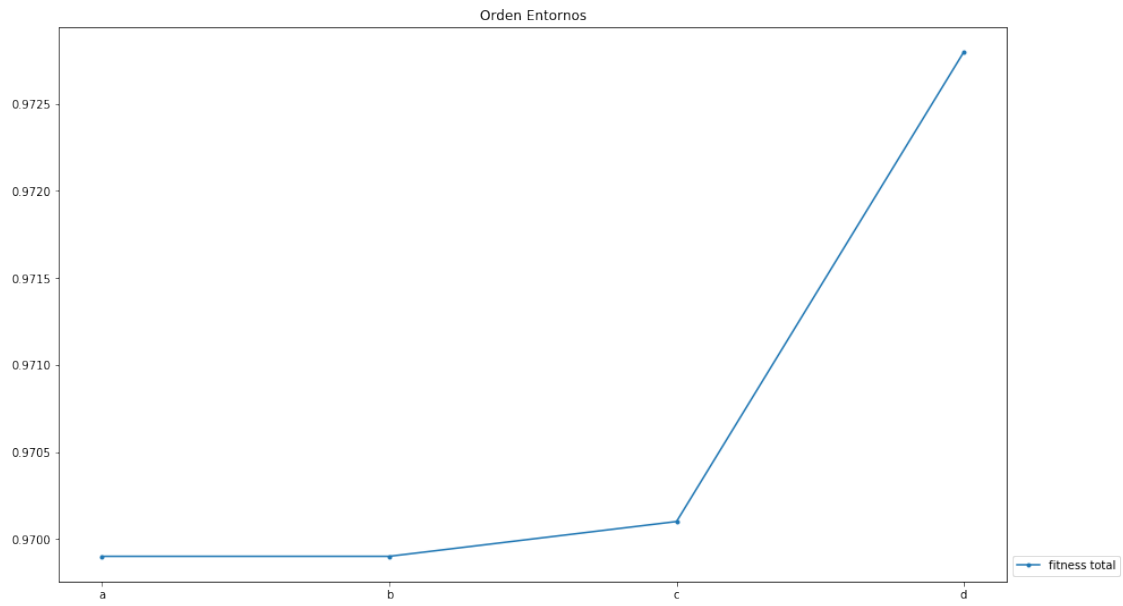
2 Estructuras de vecindad y orden

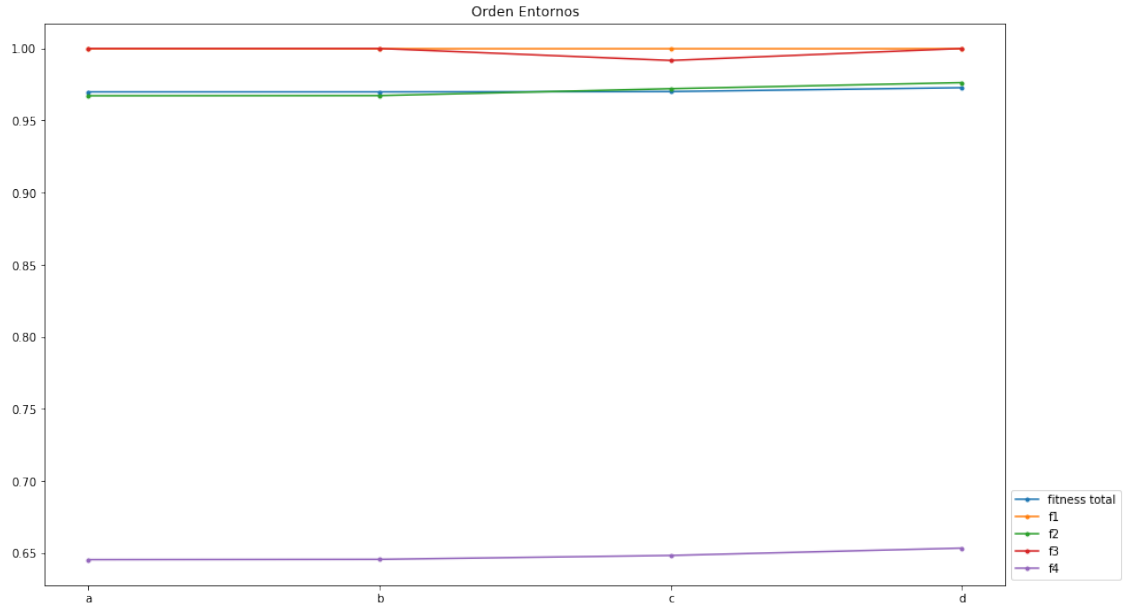
Las estructuras de vecindad propuestas son:

- 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

	iteracion	tiempo (ms)	fitness total	f1	f2	f3	f4	restricciones
a	19501.0	60012.2	0.9699	1.0	0.9672	1.0000	0.6453	14.1494
b	17501.0	152021.9	0.9699	1.0	0.9673	1.0000	0.6455	14.1056
c	15501.0	105703.1	0.9701	1.0	0.9721	0.9917	0.6482	12.0556
d	18501.0	126153.1	0.9728	1.0	0.9763	1.0000	0.6533	10.2589





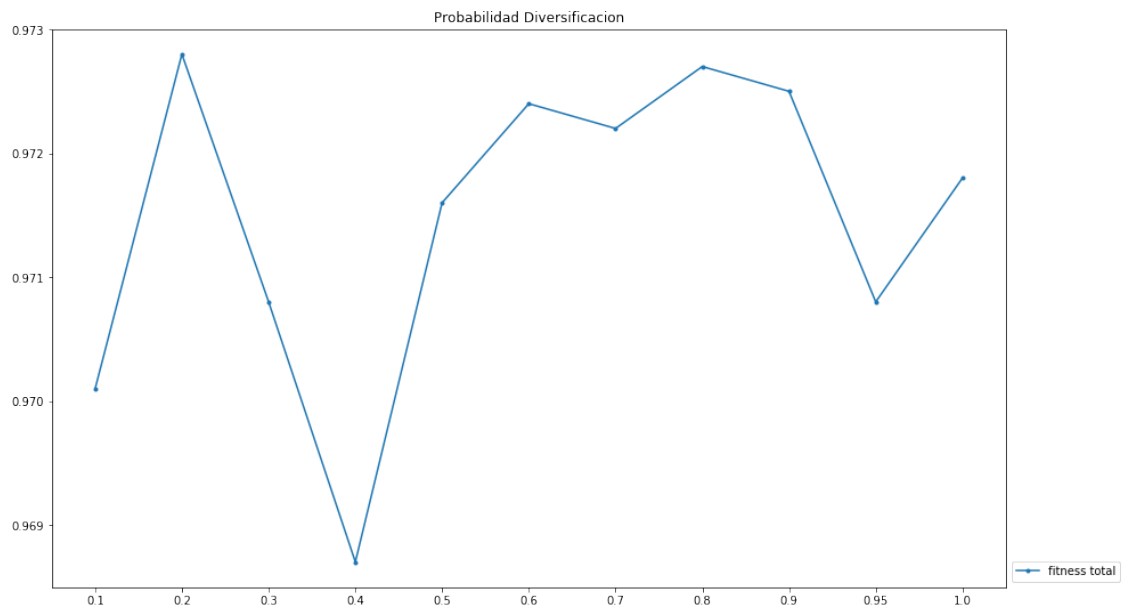
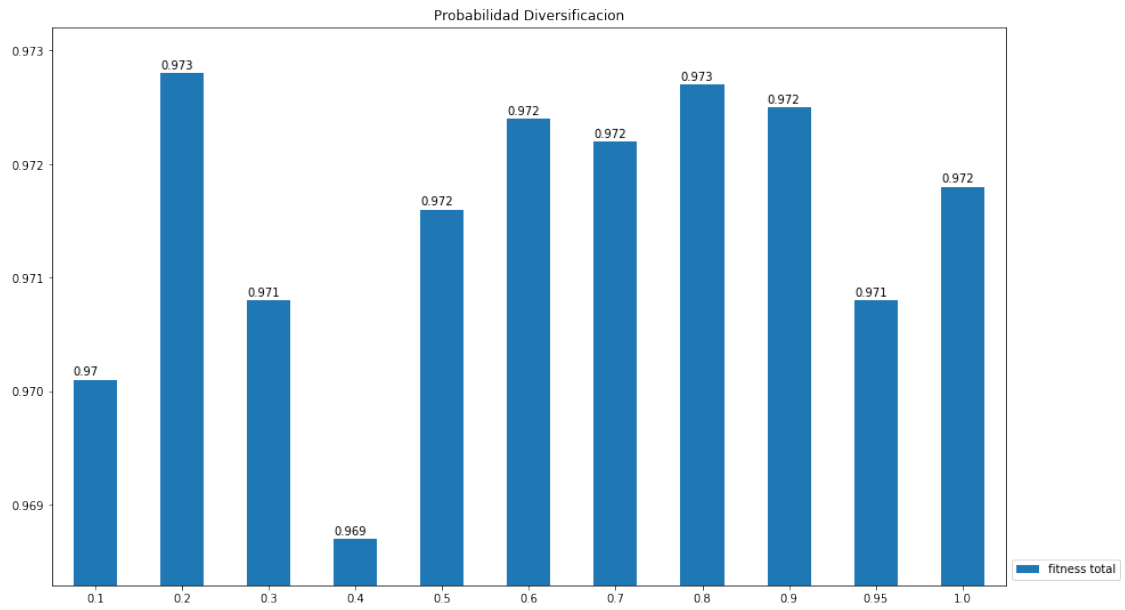


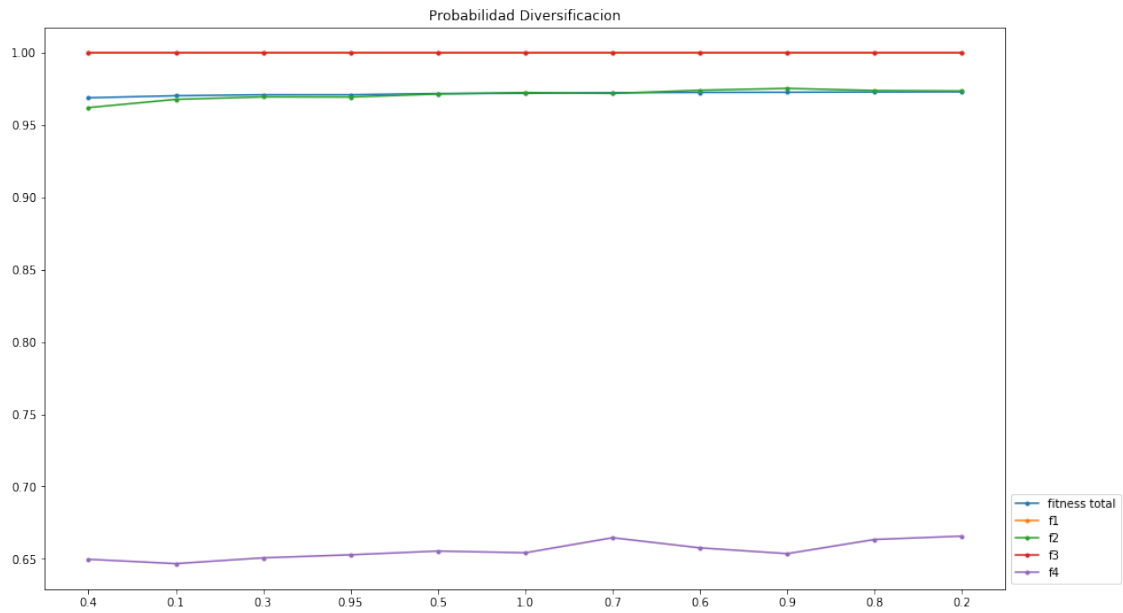
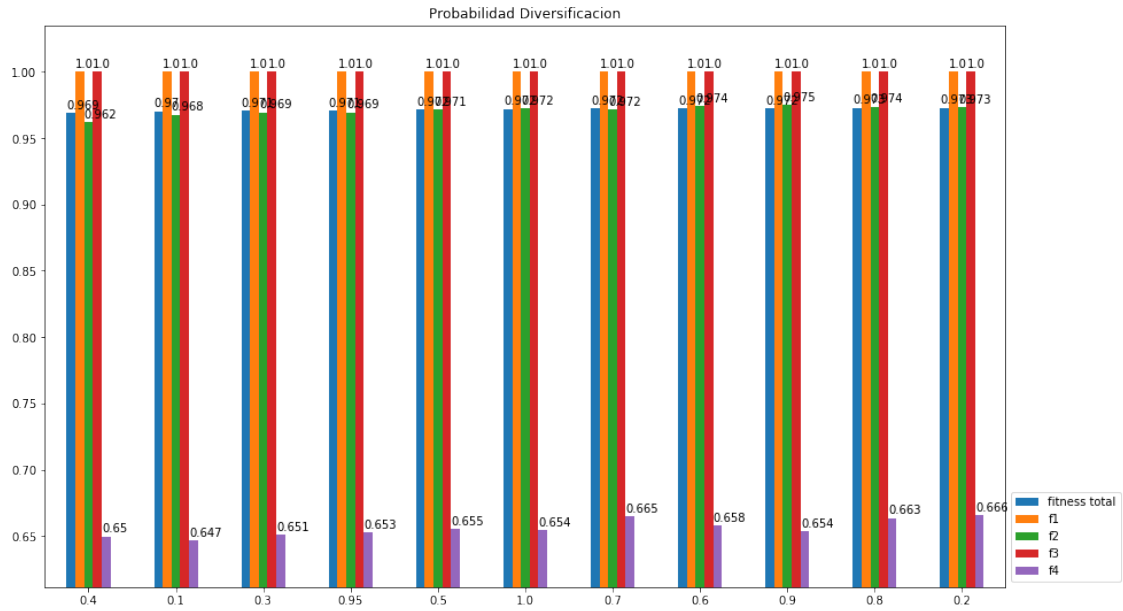
3 Naturaleza del orden de los entornos

3.1 Probabilístico

3.1.1 Probabilidad de diversificación

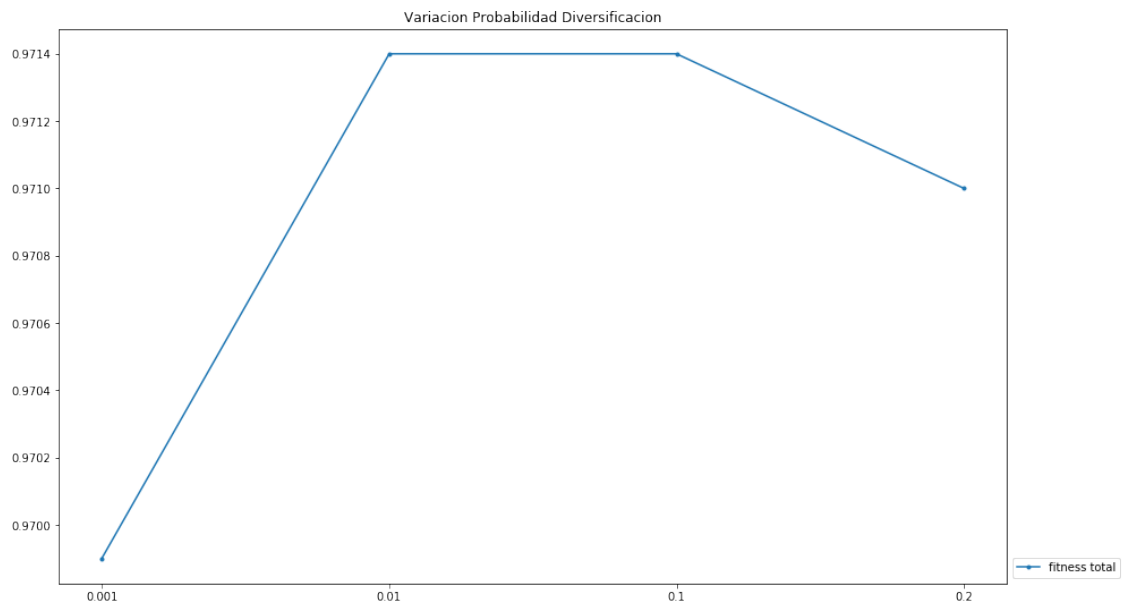
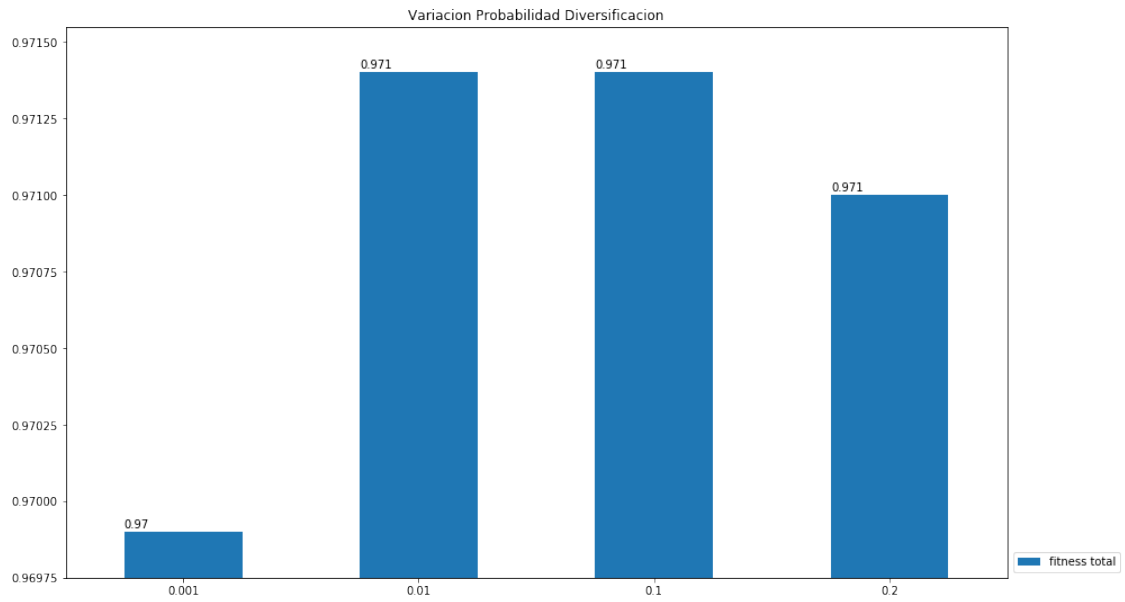
	iteracion	tiempo (ms)	fitness total	f1	f2	f3	f4	restricciones
0.4	21501.0	183128.2	0.9687	1.0	0.9619	1.0	0.6497	16.4467
0.1	16501.0	138304.2	0.9701	1.0	0.9676	1.0	0.6467	13.9756
0.3	17001.0	139842.9	0.9708	1.0	0.9693	1.0	0.6507	13.2461
0.95	19001.0	157625.3	0.9708	1.0	0.9692	1.0	0.6528	13.3111
0.5	17001.0	145786.5	0.9716	1.0	0.9713	1.0	0.6554	12.3917
1.0	16501.0	136258.7	0.9718	1.0	0.9723	1.0	0.6542	11.9783
0.7	19001.0	159802.4	0.9722	1.0	0.9717	1.0	0.6646	12.2117
0.6	17001.0	139629.1	0.9724	1.0	0.9739	1.0	0.6576	11.2550
0.9	18001.0	151563.7	0.9725	1.0	0.9752	1.0	0.6536	10.7161
0.8	20501.0	173504.5	0.9727	1.0	0.9737	1.0	0.6634	11.3428
0.2	22501.0	186136.5	0.9728	1.0	0.9734	1.0	0.6657	11.4772

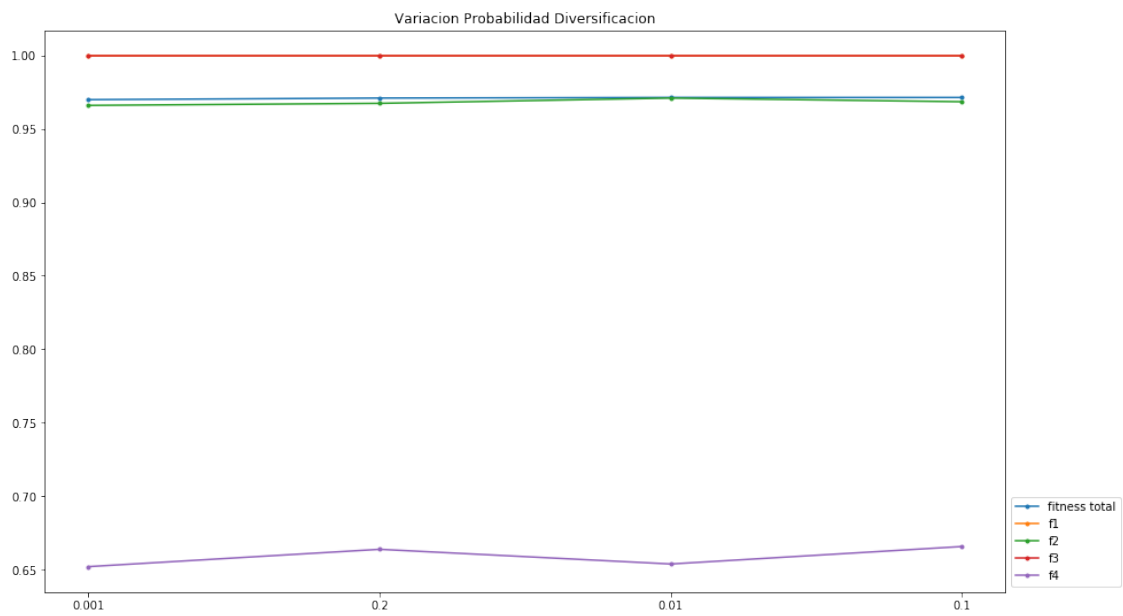
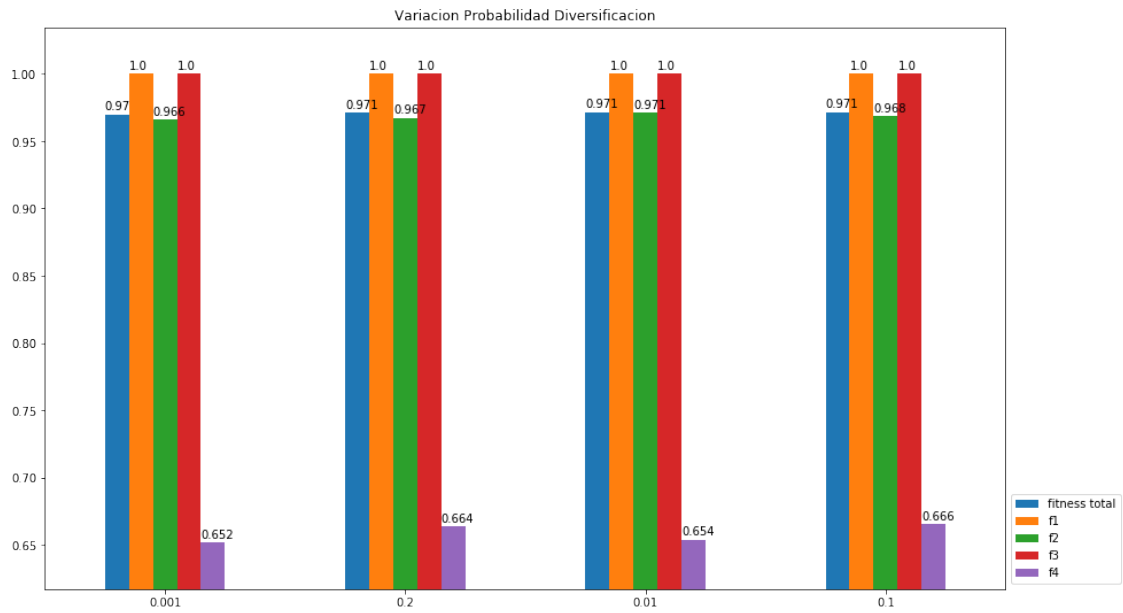




3.1.2 Variación de la probabilidad de diversificación

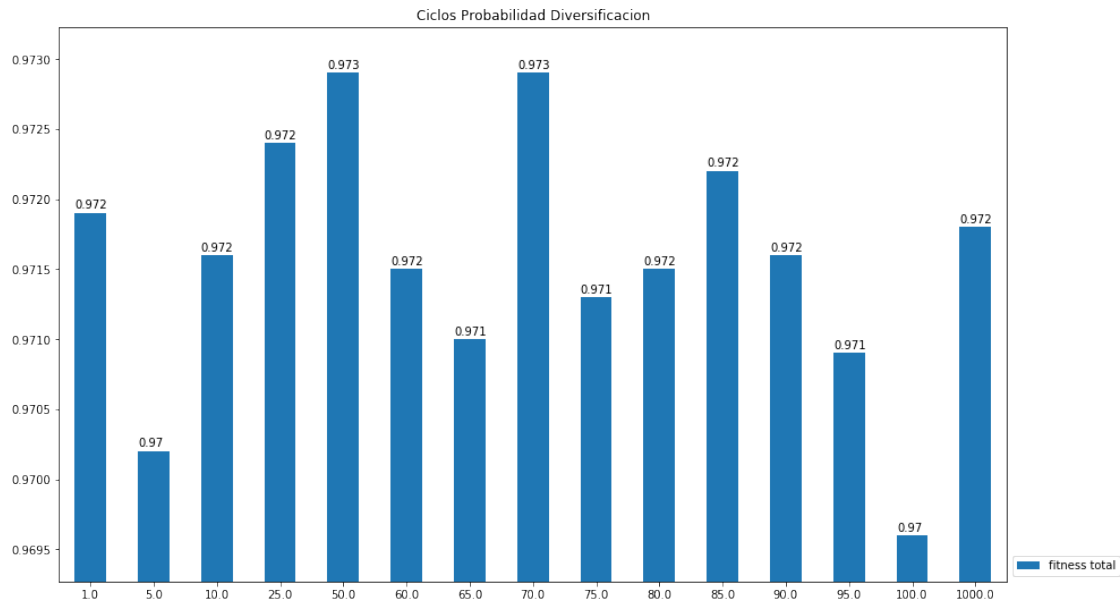
	iteracion	tiempo (ms)	fitness total	f1	f2	f3	f4	restricciones
0.001	18001.0	151145.7	0.9699	1.0	0.9660	1.0	0.6518	14.6667
0.2	21501.0	179948.6	0.9710	1.0	0.9674	1.0	0.6636	14.0961
0.01	17001.0	143702.1	0.9714	1.0	0.9710	1.0	0.6536	12.5072
0.1	15501.0	133200.8	0.9714	1.0	0.9685	1.0	0.6655	13.5972

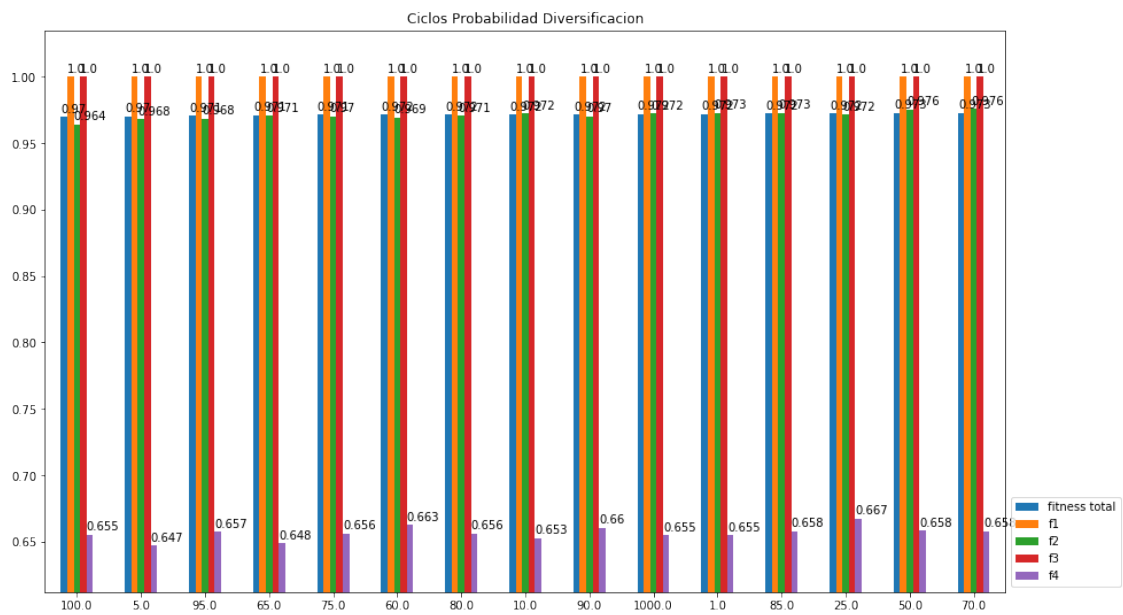
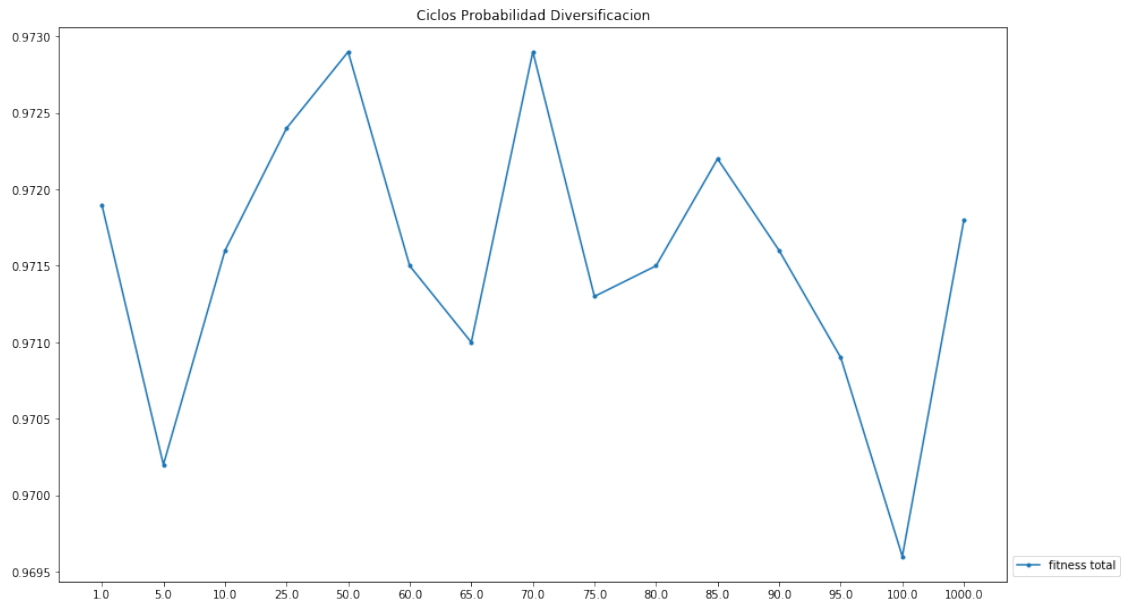


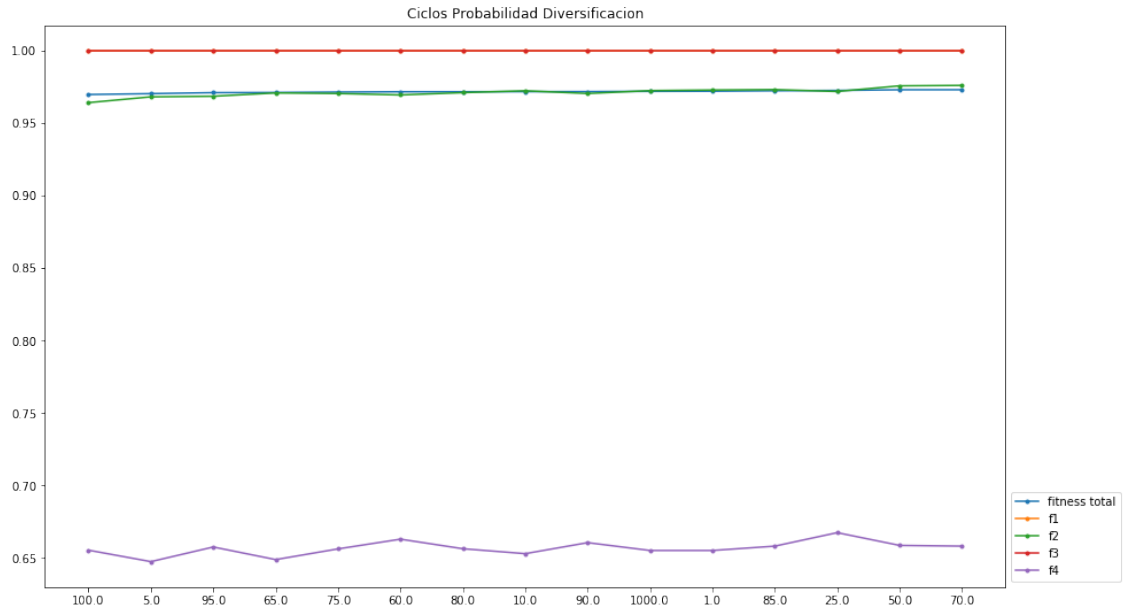


3.1.3 Numero de iteraciones sin variar la probabilidad de diversificación

	iteracion	tiempo (ms)	fitness total	f1	f2	f3	f4	restricciones
100.0	19001.0	163391.0	0.9696	1.0	0.9640	1.0	0.6550	15.5439
5.0	17501.0	149121.7	0.9702	1.0	0.9680	1.0	0.6471	13.8139
95.0	17501.0	146374.5	0.9709	1.0	0.9684	1.0	0.6572	13.6694
65.0	20501.0	172944.4	0.9710	1.0	0.9707	1.0	0.6485	12.6533
75.0	21001.0	173714.1	0.9713	1.0	0.9703	1.0	0.6559	12.8161
60.0	18501.0	154758.5	0.9715	1.0	0.9693	1.0	0.6626	13.2694
80.0	18001.0	153734.2	0.9715	1.0	0.9709	1.0	0.6560	12.5572
10.0	16501.0	140942.9	0.9716	1.0	0.9722	1.0	0.6526	12.0144
90.0	18001.0	149804.1	0.9716	1.0	0.9703	1.0	0.6602	12.8517
1000.0	17501.0	152258.9	0.9718	1.0	0.9723	1.0	0.6548	11.9778
1.0	17501.0	147330.2	0.9719	1.0	0.9727	1.0	0.6548	11.7950
85.0	19001.0	163392.9	0.9722	1.0	0.9730	1.0	0.6578	11.6633
25.0	18501.0	155784.0	0.9724	1.0	0.9717	1.0	0.6671	12.2239
50.0	18501.0	156375.6	0.9729	1.0	0.9756	1.0	0.6583	10.5222
70.0	19001.0	162373.6	0.9729	1.0	0.9759	1.0	0.6578	10.4311

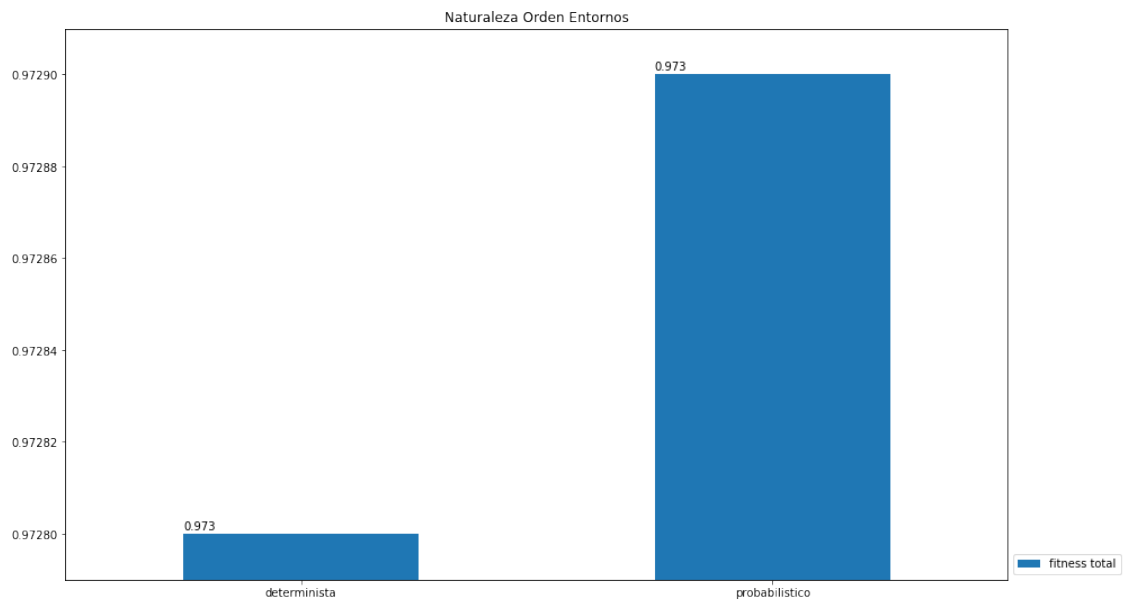


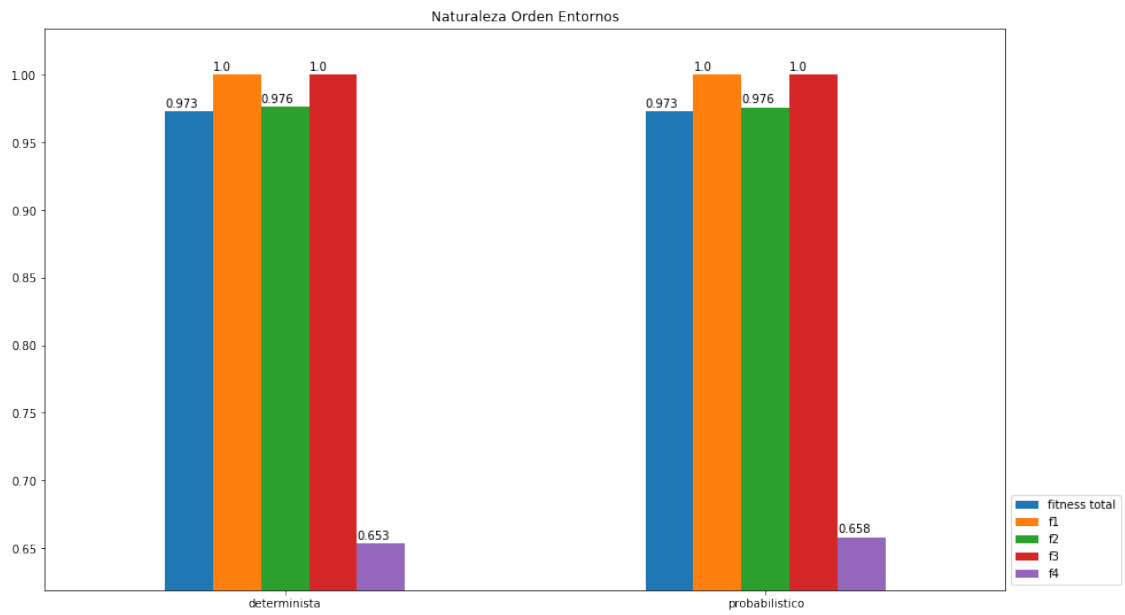
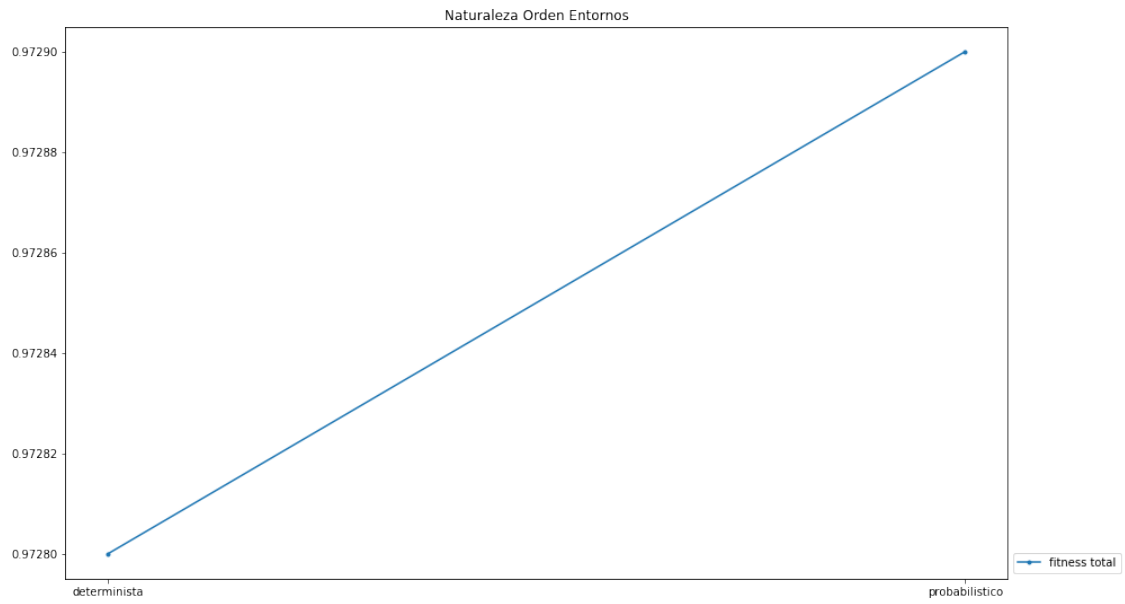


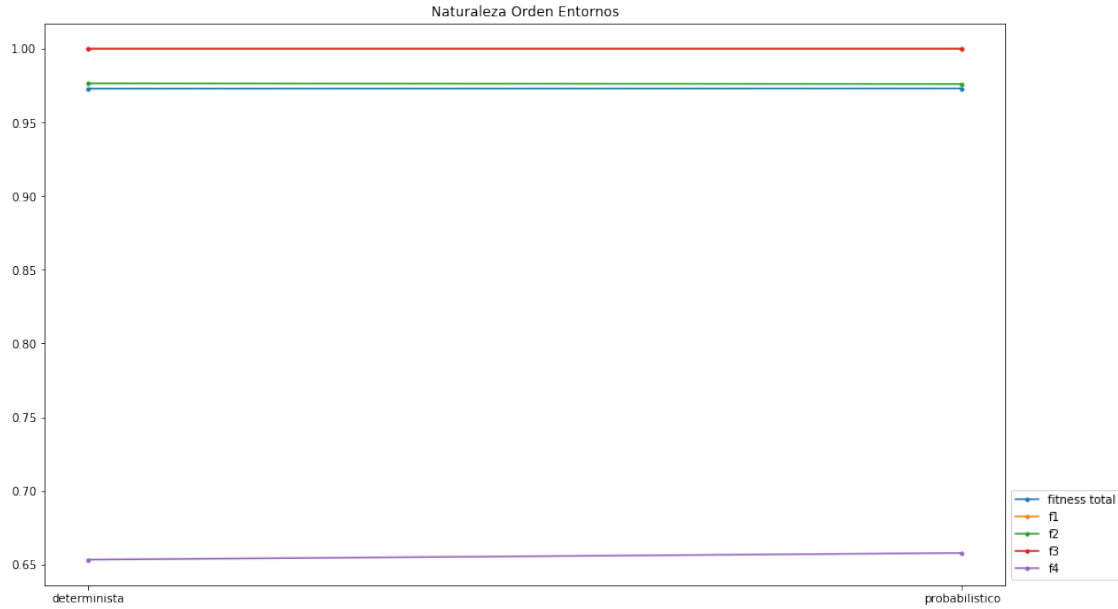


3.2 Determinista vs Probabilistico

	iteracion	tiempo (ms)	fitness total	f1	f2	f3	f4	restricciones
determinista	18501.0	126153.1	0.9728	1.0	0.9763	1.0	0.6533	10.2589
probabilistico	19001.0	162373.6	0.9729	1.0	0.9759	1.0	0.6578	10.4311





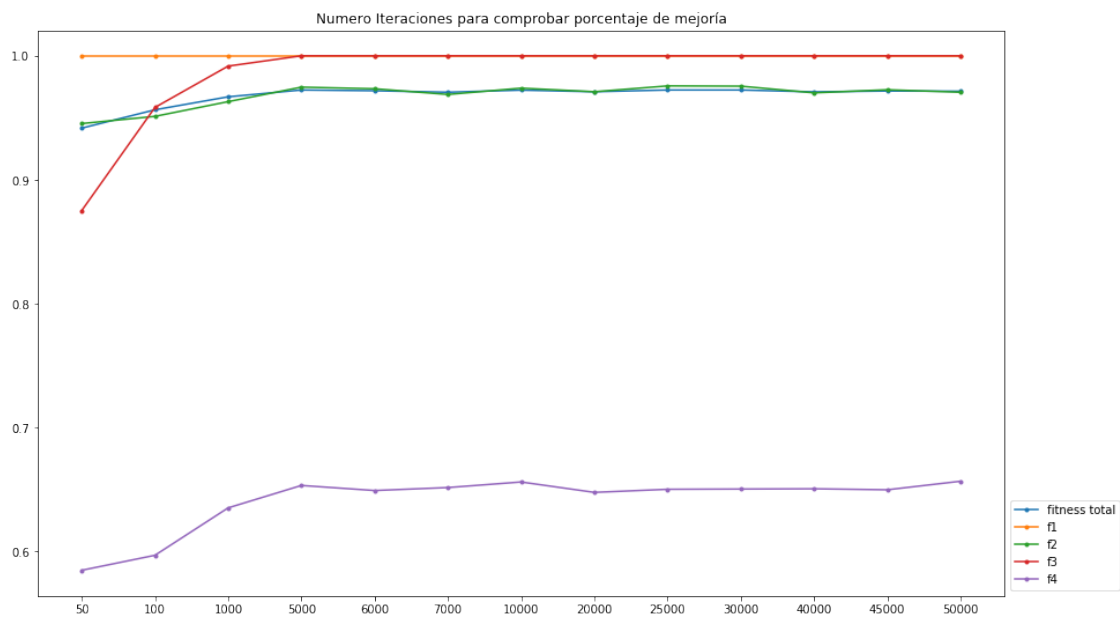
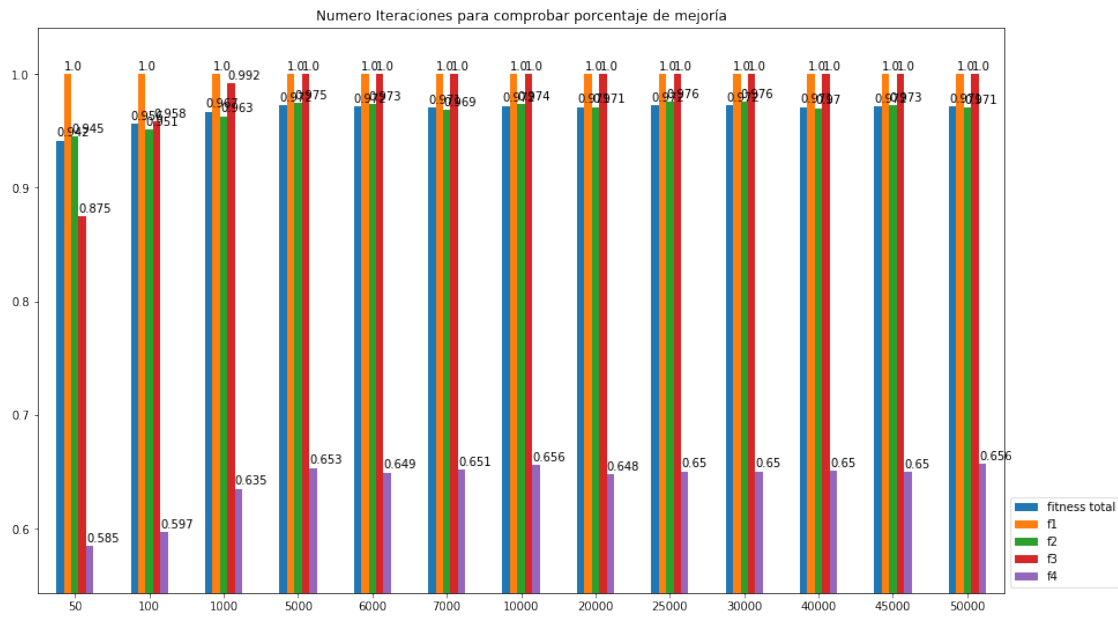


Podemos apreciar que la diferencia entre probabilistico y determinista es muy pequeña, y teniendo en cuenta el coste computacional que este último implica, no resulta eficiente, al menos para este caso, emplear este tipo de selección de entornos

$$NaturalezaEntornos = Determinista$$

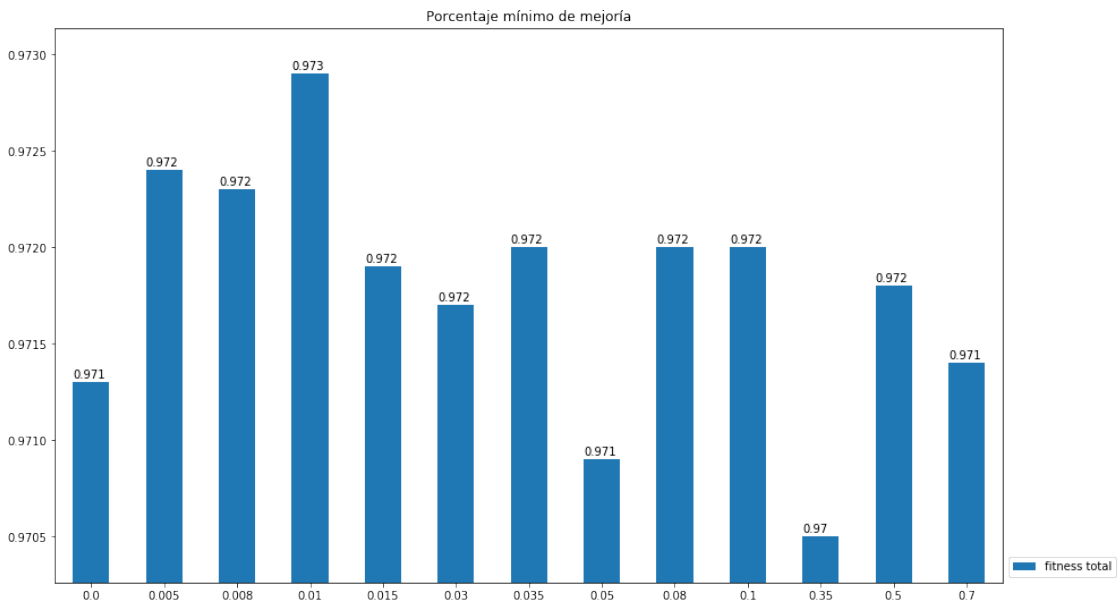
4 Número de iteraciones para comprobar el porcentaje de mejoría (ciclos)

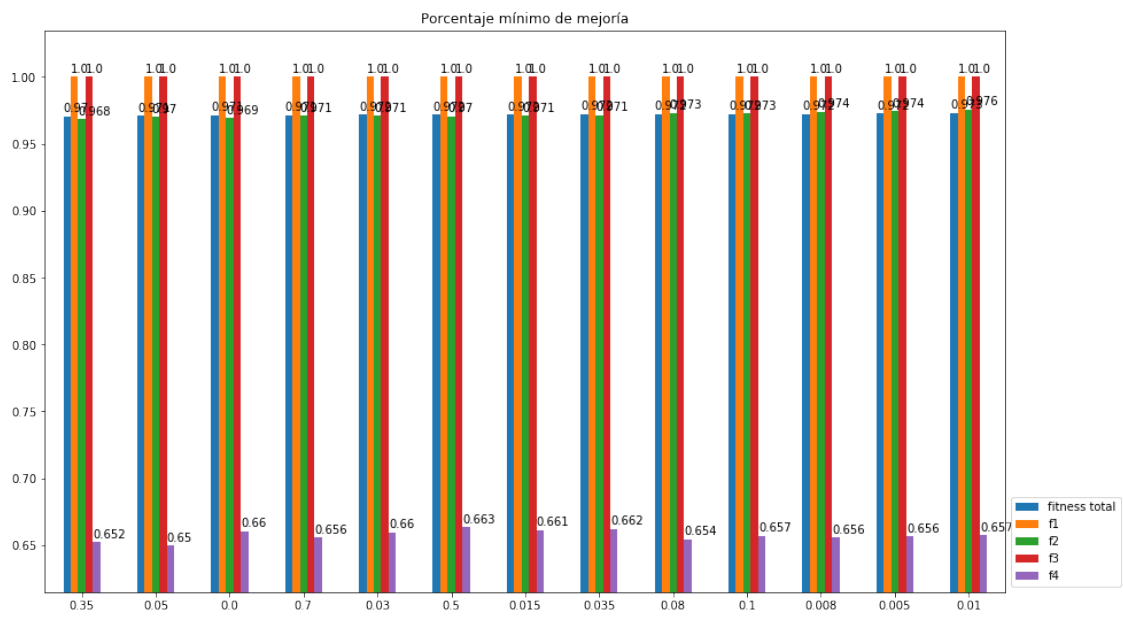
	iteracion	tiempo (ms)	fitness total	f1	f2	f3	f4	restricciones
50	401.0	4263.50	0.9416	1.0	0.9453	0.8750	0.5846	23.6250
100	711.0	7373.10	0.9564	1.0	0.9511	0.9583	0.5967	21.1122
1000	5501.0	53193.10	0.9669	1.0	0.9630	0.9917	0.6350	15.9689
7000	21701.0	179395.40	0.9706	1.0	0.9688	1.0000	0.6514	13.4978
40000	80001.0	568982.10	0.9709	1.0	0.9701	1.0000	0.6504	12.9283
20000	40001.0	303861.20	0.9710	1.0	0.9710	1.0000	0.6475	12.5494
50000	100001.0	600097.10	0.9714	1.0	0.9706	1.0000	0.6565	12.7189
45000	90001.0	600035.90	0.9716	1.0	0.9726	1.0000	0.6496	11.8306
6000	16201.0	137865.00	0.9718	1.0	0.9734	1.0000	0.6490	11.4733
10000	27001.0	218714.55	0.9723	1.0	0.9739	1.0000	0.6559	11.2903
5000	17501.0	151138.40	0.9724	1.0	0.9747	1.0000	0.6531	10.9256
25000	50001.0	371645.90	0.9724	1.0	0.9757	1.0000	0.6500	10.4994
30000	60001.0	440762.70	0.9724	1.0	0.9755	1.0000	0.6502	10.5672

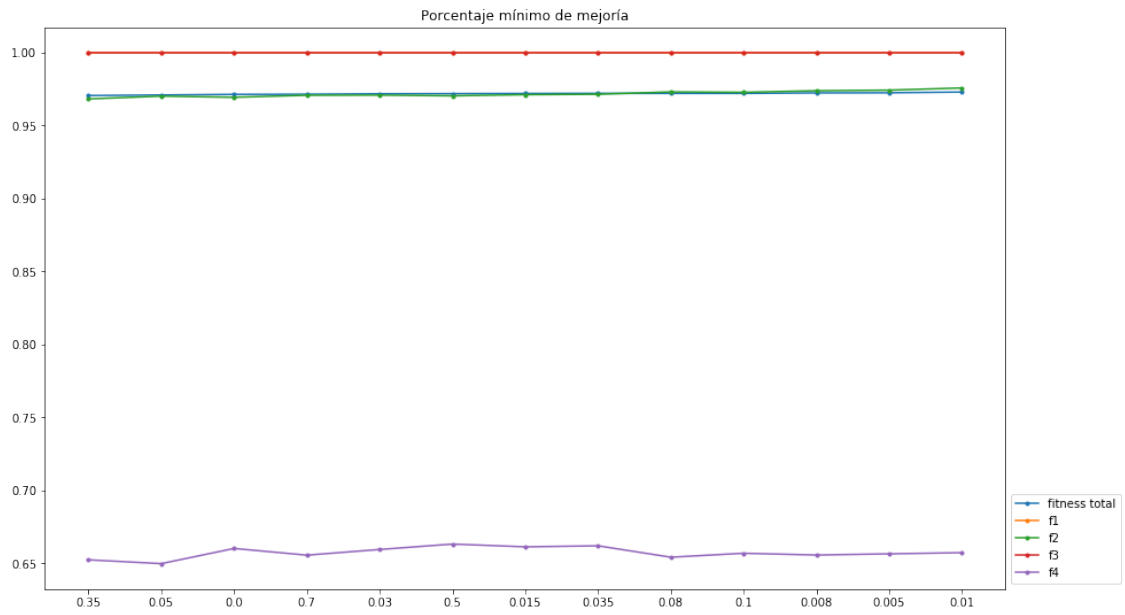


5 Porcentaje mínimo de mejoría

	iteracion	tiempo (ms)	fitness total	f1	f2	f3	f4	restricciones
0.35	50001.0	373482.1	0.9705	1.0	0.9682	1.0	0.6524	13.7517
0.05	50001.0	377199.8	0.9709	1.0	0.9701	1.0	0.6498	12.9156
0.0	92501.0	251653.6	0.9713	1.0	0.9693	1.0	0.6602	13.2606
0.7	50001.0	367778.4	0.9714	1.0	0.9707	1.0	0.6556	12.6711
0.03	50001.0	372798.9	0.9717	1.0	0.9708	1.0	0.6595	12.6044
0.5	50001.0	371365.5	0.9718	1.0	0.9703	1.0	0.6632	12.8183
0.015	52501.0	388785.2	0.9719	1.0	0.9711	1.0	0.6613	12.5050
0.035	50001.0	364596.9	0.9720	1.0	0.9714	1.0	0.6620	12.3350
0.08	50001.0	361286.7	0.9720	1.0	0.9730	1.0	0.6542	11.6444
0.1	50001.0	372813.1	0.9720	1.0	0.9727	1.0	0.6569	11.7856
0.008	57501.0	416814.5	0.9723	1.0	0.9738	1.0	0.6557	11.3356
0.005	50001.0	361710.2	0.9724	1.0	0.9742	1.0	0.6565	11.1650
0.01	50001.0	360940.2	0.9729	1.0	0.9757	1.0	0.6573	10.5189

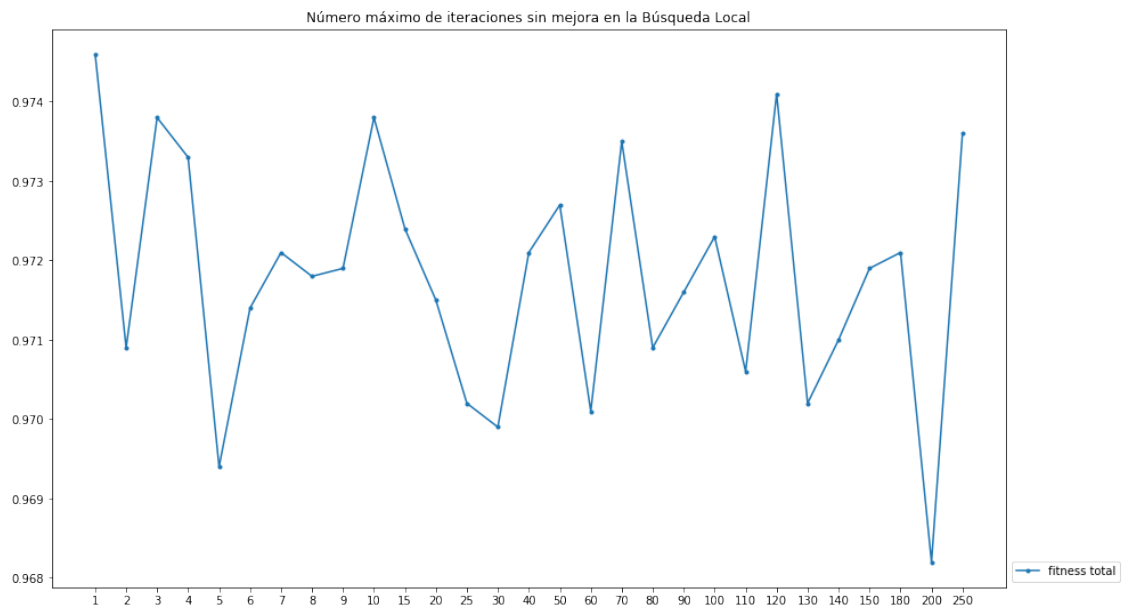
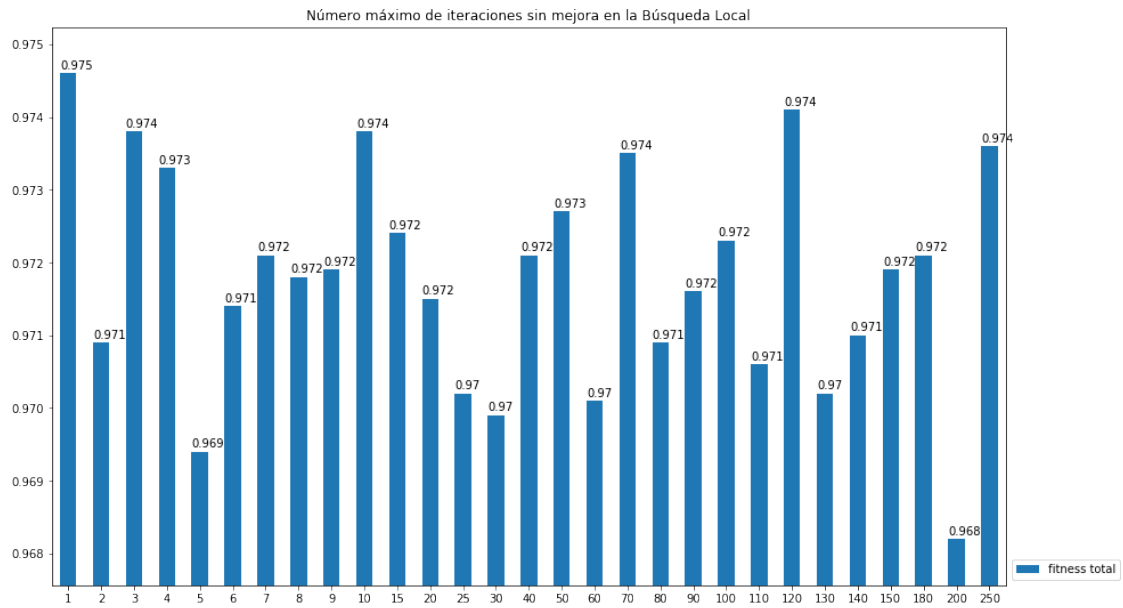






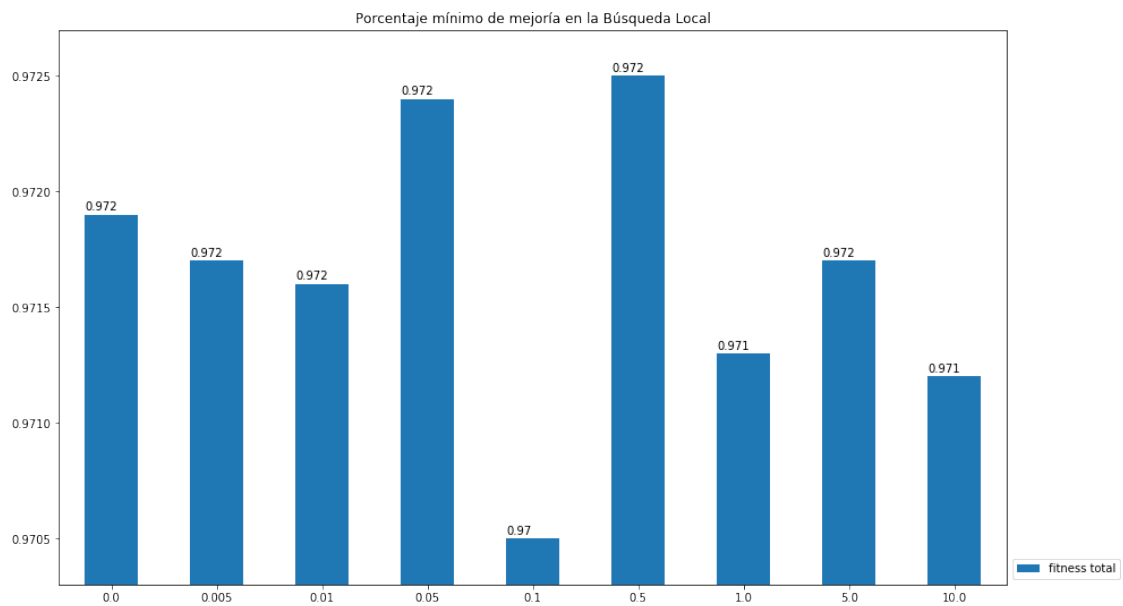
6 Número máximo de iteraciones sin mejora en la Búsqueda Local

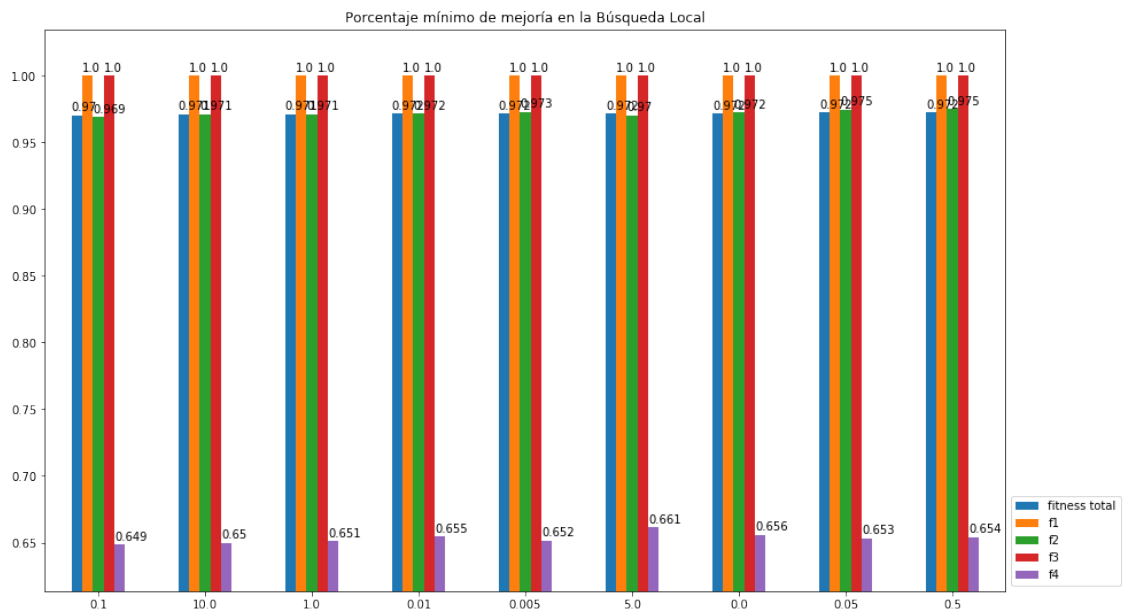
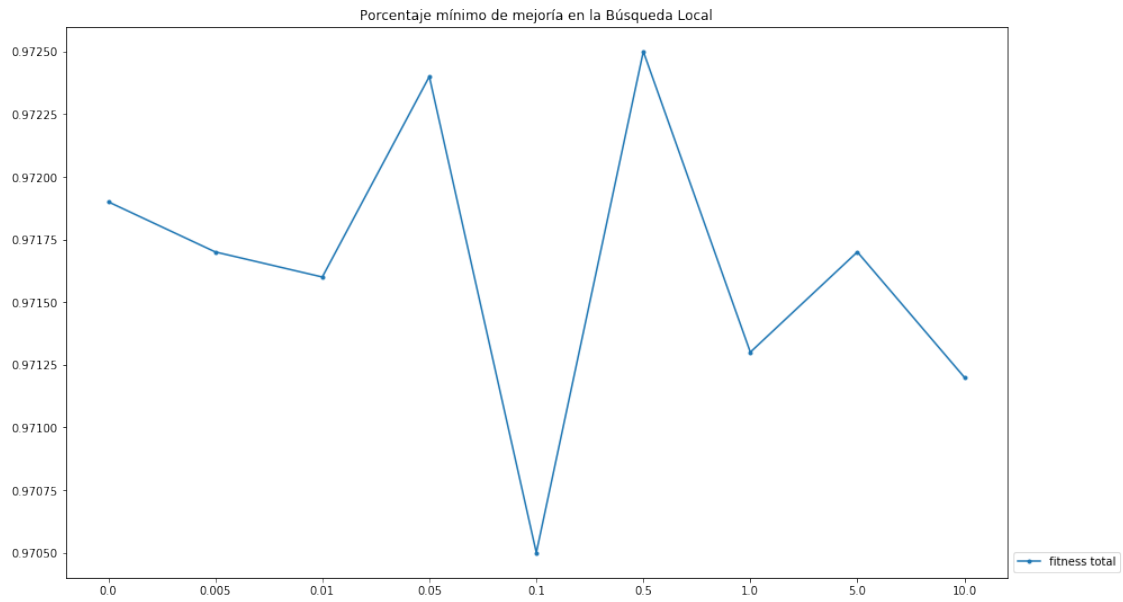
	iteracion	tiempo (ms)	fitness total	f1	f2	f3	f4	restricciones
200	50001.0	11148936.0	0.9682	1.0	0.9580	1.0	0.6584	18.1556
5	50001.0	374447.0	0.9694	1.0	0.9626	1.0	0.6584	16.1556
30	50001.0	1764069.0	0.9699	1.0	0.9674	1.0	0.6444	14.1000
60	50001.0	3375454.0	0.9701	1.0	0.9622	1.0	0.6724	16.3167
130	50001.0	7511078.0	0.9702	1.0	0.9669	1.0	0.6529	14.2944
25	50001.0	1506424.0	0.9702	1.0	0.9624	1.0	0.6724	16.2611
110	50001.0	6135875.0	0.9706	1.0	0.9693	1.0	0.6481	13.2667
2	50001.0	197389.0	0.9709	1.0	0.9673	1.0	0.6618	14.1111
80	50001.0	4505963.0	0.9709	1.0	0.9717	1.0	0.6422	12.2278
140	50001.0	7806795.0	0.9710	1.0	0.9742	1.0	0.6323	11.1556
6	50001.0	415765.0	0.9714	1.0	0.9745	1.0	0.6385	11.0000
20	50001.0	1101661.0	0.9715	1.0	0.9670	1.0	0.6728	14.2389
90	50001.0	5226007.0	0.9716	1.0	0.9672	1.0	0.6746	14.1556
8	50001.0	501051.0	0.9718	1.0	0.9694	1.0	0.6676	13.2056
150	50001.0	8378491.0	0.9719	1.0	0.9716	1.0	0.6588	12.2556
9	50001.0	606695.0	0.9719	1.0	0.9742	1.0	0.6485	11.1611
7	50001.0	472371.0	0.9721	1.0	0.9767	1.0	0.6393	10.0778
180	50001.0	10334865.0	0.9721	1.0	0.9698	1.0	0.6713	13.0500
40	50001.0	2190900.0	0.9721	1.0	0.9740	1.0	0.6525	11.2444
100	50001.0	5379946.0	0.9723	1.0	0.9721	1.0	0.6647	12.0722
15	50001.0	920301.0	0.9724	1.0	0.9785	1.0	0.6367	9.2889
50	50001.0	2756570.0	0.9727	1.0	0.9768	1.0	0.6492	10.0111
4	50001.0	318203.0	0.9733	1.0	0.9765	1.0	0.6614	10.1333
70	50001.0	3738133.0	0.9735	1.0	0.9765	1.0	0.6647	10.1556
250	50001.0	13926011.0	0.9736	1.0	0.9743	1.0	0.6750	11.1167
10	50001.0	615980.0	0.9738	1.0	0.9763	1.0	0.6702	10.2444
3	75001.0	366848.0	0.9738	1.0	0.9789	1.0	0.6588	9.1000
120	50001.0	6455867.0	0.9741	1.0	0.9814	1.0	0.6514	8.0222
1	75001.0	194768.0	0.9746	1.0	0.9792	1.0	0.6706	9.0000

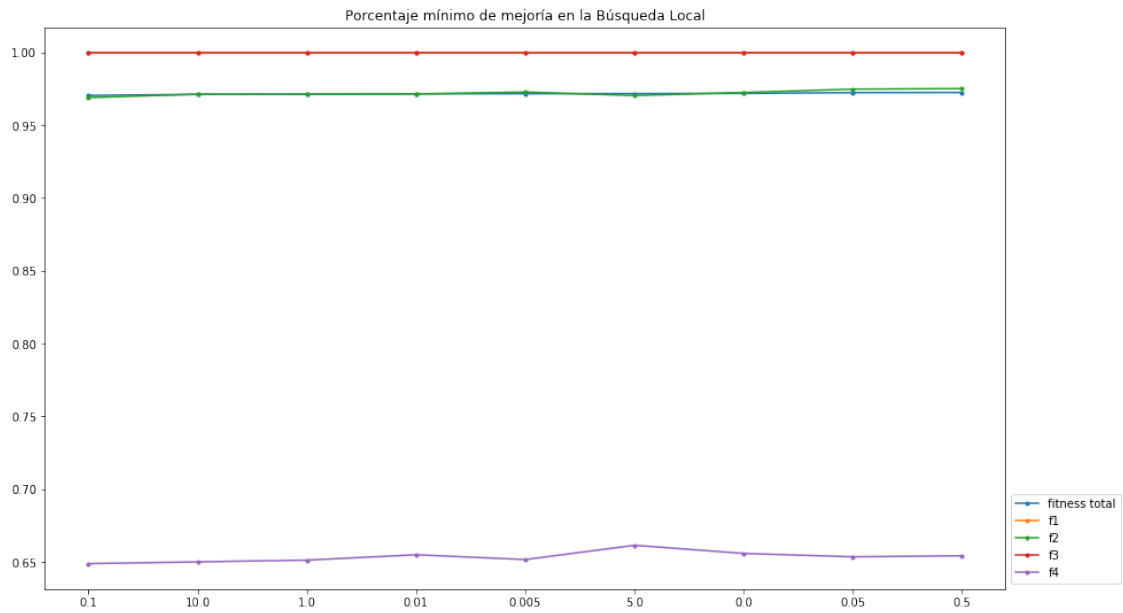


7 Porcentaje mínimo de mejoría en la Búsqueda Local

	iteracion	tiempo (ms)	fitness total	f1	f2	f3	f4	restricciones
0.1	75001.0	208476.6	0.9705	1.0	0.9690	1.0	0.6487	13.4106
10.0	77501.0	215262.6	0.9712	1.0	0.9713	1.0	0.6499	12.4172
1.0	80001.0	220496.4	0.9713	1.0	0.9713	1.0	0.6511	12.3861
0.01	85001.0	236612.1	0.9716	1.0	0.9715	1.0	0.6548	12.3089
0.005	72501.0	200456.2	0.9717	1.0	0.9728	1.0	0.6515	11.7706
5.0	72501.0	199399.5	0.9717	1.0	0.9704	1.0	0.6613	12.7761
0.0	82501.0	226294.6	0.9719	1.0	0.9725	1.0	0.6557	11.8589
0.05	90001.0	248481.8	0.9724	1.0	0.9748	1.0	0.6534	10.8767
0.5	80001.0	215265.5	0.9725	1.0	0.9752	1.0	0.6541	10.7317







A continuación repetimos el proceso de nuevo desde el principio para obtener los valores definitivos.