Raport Tema 1

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1 Introducere

1.1 Problema

Aflarea punctului de minim pentru mai multe functii.

1.2 Motivatie

Implementarea si testarea metodelor Hill Climbing (first and best) si Simulated Anneling pe 4 functii pentru a vedea comportamentul fiecarui algoritm in aflarea minimului pentru functiile date.

2 Functii:

Am ales pentru testare urmatoarele functii:

$$f(X) = (x_1 - 1)^2 + \sum_{i=2}^{n} i \left(2x_i^2 - x_{i-1}\right)^2, -10 \le x_i \le 10$$

Figure 1: Dixon Price

$$f(x) = A \cdot n + \sum_{i=1}^{n} \left[x_i^2 - A \cdot cos(2\pi x_i)\right], A = 10, x_i \in [-5.12, 5.15]$$

Figure 2: Rastrigin's

$$f(x,y) = \sum_{i=1}^{n} [b(x_{i+1} - x_i^2)^2 + (a - x_i)^2], -5 \le x_i \le 10$$

Figure 3: Rosenbrock

$$f(\mathbf{x}) = f(x_1, x_2, ..., x_n) = \sum_{i=1}^{n} x_i^2, -5.12 \le x_i \le 5.12$$

Figure 4: Sphere

3 Experiment

Am rulat cei 3 algoritmi pe 4 functii diferite. Fiecare algoritm a fost rulat de 30 de ori iar rezultatele scrise intr-un fisier pentru a face statistici.

4 Rezultate

alg	min	max	avg	median	σ
HCF2	0.00097	67.25	3.36636	1.16846	11.89117
HCF5	0.51566	68.2299	5.58065	1.20334	16.74513
HCF10	0.58607	69.3085	8.65992	1.35572	20.30719

Figure 5: Hill Climbing First rulat pe Dixon Price

alg	min	max	media	mediana	σ
HCB2	0.00097	16.1469	3.40608	1.17051	5.11684
HCB5	0.0614	69.7109	8.17996	1.21286	17.21181
HCB10	0.61253	8.36638	2.542	1.28523	2.28029

Figure 6: Hill Climbing Best rulat pe Dixon Price

alg	min	max	media	mediana	σ
SA2	0.63928	11489.1	1021.0986	69.5316	2473.28962
SA5	243.096	189597.0	41218.98977	25036.8	46837.88725
SA10	16256.4	467061.0	210757.26333	205247.5	114130.69571

Figure 7: Simulated Annealing rulat pe Dixon Price

alg	min	max	media	mediana	σ
HCF2	0.8464	12.7616	3.64144	4.0	2.55532
HCF5	2.6176	22.9776	11.05157	9.6072	5.31155
HCF10	10.3792	35.1968	20.25387	19.1352	6.76937
HCF20	25.0736	55.9728	39.57573	38.8696	7.07689

Figure 8: Hill Climbing First rulat pe Rastrigin

alg	min	max	media	mediana	σ
HCB2	0.0	8.0	3.23627	3.9208	2.25398
HCB5	0.9232	16.3728	8.31248	8.2584	3.62277
HCB10	4.8512	26.8368	15.92085	15.6096	4.71552
HCB20	20.1616	49.5888	34.10155	32.9064	7.33777

Figure 9: Hill Climbing Best rulat pe Rastrigin

alg	min	max	media	mediana	σ
SA2	1.0256	29.088	11.8944	10.624	8.01362
SA5	5.0224	69.1488	32.28171	29.3232	16.46413
SA10	30.376	113.413	73.64927	72.6464	19.7759
SA20	106.189	212.261	164.644	163.3275	26.85795

Figure 10: Simulated Annealing rulat pe Rastrigin

alg	min	max	media	mediana	σ
HCF2	0.08145	357.504	32.28417	5.43366	71.73042
HCF5	5.42354	3721.23	1877.16871	2118.635	1332.21238
HCF10	384.344	7649.45	4386.39647	4249.85	1802.41128

Figure 11: Hill Climbing First rulat pe Rosenbrock

alg	min	max	media	mediana	σ
HCB2	0.02112	17.0156	5.62122	3.54339	5.01698
HCB5	2.99563	3721.53	1286.50744	1338.78	1101.016
HCB10	222.561	8395.91	4022.71593	3784.22	2330.33396

Figure 12: Hill Climbing Best rulat pe Rosenbrock

alg	min	max	media	mediana	σ
SA2	4.88342	210226.0	26800.69082	1197.902	54924.28439
SA5	2204.45	778428.0	212594.252	135071.5	210322.41932
SA10	25026.2	2045420.0	538330.74667	428601.0	437318.45854

Figure 13: Simulated Annealing rulat pe Rosenbrock

alg		min	max	media	mediana	σ
HCF2		0.0	0.0032	0.00144	0.0016	0.00119
HCF5		0.0016	0.008	0.00459	0.0048	0.00184
HCF10		0.0016	0.0128	0.00816	0.008	0.00281

Figure 14: Hill Climbing First rulat pe Sphere

alg		min	max	media	mediana	σ
HCB2		0.0	0.0032	0.00187	0.0016	0.00131
HCB5		0.0016	0.008	0.00416	0.0032	0.00183
HCB10		0.0016	0.0096	0.00656	0.0064	0.00242

Figure 15: Hill Climbing Best rulat pe Sphere

alg		min	max	media	mediana	σ
SA2		0.0272	18.792	7.77051	7.5144	5.56947
SA5		7.6656	71.5952	28.19035	25.8128	13.49822
SA10		29.3776	117.981	64.72599	58.8432	20.69088

Figure 16: Simulated Annealing rulat pe Sphere

4.1   Interpretation

5   Concluzie

Din datele colectate se poate observa ca pe functiile alese Hill Climbing este un algoritm mai bun pentru determinarea minimului decat Simulated Annealing.

References