

ESTUDO DE PROFUNDIDADE EM GRAFOS ALEATÓRIOS

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Teoria dos Grafos
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Erdos-Renyi Model

Definição da função

```
int igraph_erdos_renyi_game(igraph_t *graph, igraph_erdos_renyi_t type,
    igraph_integer_t n, igraph_real_t p_or_m,
    igraph_bool_t directed, igraph_bool_t loops);
```

Complexidade computacional

Time complexity: $O(|V|+|E|)$, the number of vertices plus the number of edges in the graph.

Parâmetros usados

```
igraph_erdos_renyi_game(&graph, //uninitialized graph object
    IGRAPH_ERDOS_RENYI_GNM, //G(n,m): m edges are selected uniformly randomly in a graph with n vertices
    vertex_n, //the number of vertices
    edge_m, //the number of edges
    IGRAPH_UNDIRECTED, //undirected graph
    IGRAPH_NO_LOOPS); //no loop (self) edges allowed
```

Resultados Obtidos

Depth-First Search

V=1000		E=3000	
depth	media	desvio	perc.media
0	0.000	0.000	0.000
1	1.015	0.151	0.001
2	2.031	0.228	0.002
3	3.060	0.314	0.003
4	4.082	0.379	0.004
5	5.110	0.450	0.005
6	6.134	0.514	0.006
7	7.161	0.572	0.007
8	8.200	0.636	0.008
9	9.235	0.694	0.009
10	10.255	0.743	0.010

Breadth-First Search

V=1000		E=3000	
depth	media	desvio	perc.media
0	0.000	0.000	0.000
1	6.000	2.415	0.006
2	40.886	17.017	0.041
3	216.726	81.632	0.217
4	694.312	150.402	0.694
5	974.642	48.586	0.975
6	998.496	2.758	0.998
7	999.000	0.000	0.999
8	999.000	0.000	0.999

Barabási-Albert Model

Definição da função

```
int igraph_barabasi_game(igraph_t *graph, igraph_integer_t n,  
    igraph_real_t power,  
    igraph_integer_t m,  
    const igraph_vector_t *outseq,  
    igraph_bool_t outpref,  
    igraph_real_t A,  
    igraph_bool_t directed,  
    igraph_barabasi_algorithm_t algo,  
    const igraph_t *start_from);
```

Complexidade computacional

Time complexity: $O(|V|+|E|)$, the number of vertices plus the number of edges.

Parâmetros usados

```
igraph_barabasi_game(&graph, vertex_n, /*power=*/ 1, edge_m / vertex_n, 0, 0, /*A=*/ 1, IGRAPH_UNDIRECTED,  
    IGRAPH_BARABASI_BAG, /*start_from=*/ 0);
```

Resultados Obtidos

Depth-First Search

	V=1000	E=3000	
depth	media	desvio	perc.media
0	0.000	0.000	0.000
1	1.002	0.045	0.001
2	2.655	0.625	0.003
3	7.148	1.804	0.007
4	12.576	2.476	0.013
5	16.217	1.593	0.016
6	18.175	2.114	0.018
7	19.645	2.619	0.020
8	20.875	3.049	0.021
9	26.914	3.602	0.027
10	30.640	2.518	0.031
11	32.188	2.826	0.032
12	35.466	4.561	0.035
13	37.837	4.773	0.038
14	39.383	5.194	0.039
15	41.032	6.197	0.041
16	42.282	6.482	0.042
17	43.426	6.631	0.043
18	49.354	6.037	0.049
19	54.110	5.239	0.054
20	56.277	5.307	0.056

Breadth-First Search

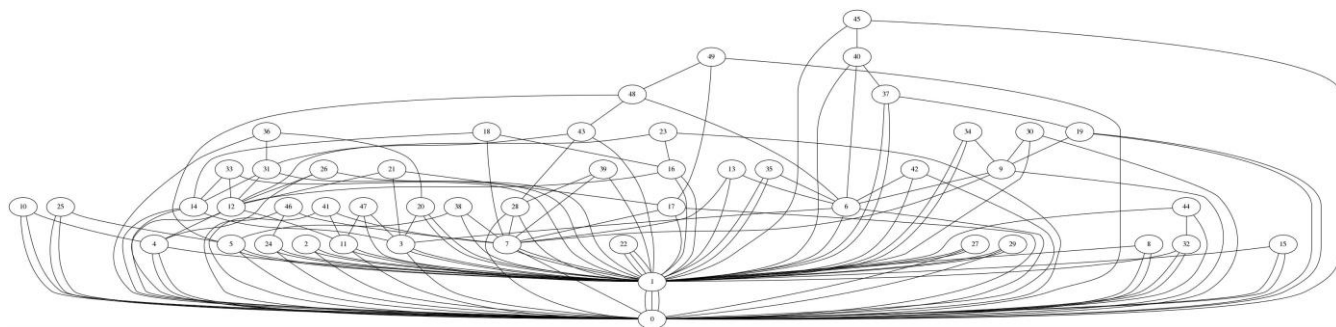
	V=1000	E=3000		
depth	media	desvio	perc.media	
0	0.000	0.000	0.000	
1	5.746	17.343	0.006	
2	300.678	176.947	0.301	
3	897.648	123.982	0.898	
4	998.256	3.321	0.998	
5	999.000	0.000	0.999	
6	999.000	0.000	0.999	

Estudo complementar - Barabási-Albert em menor escala

Breadth-First Search

	V=50	E=150		
depth	media	desvio	perc.media	
0	0.000	0.000	0.000	
1	1.020	0.141	0.020	
2	2.600	1.400	0.052	
3	9.720	1.762	0.194	
4	12.240	0.938	0.245	
5	15.280	1.213	0.306	
6	19.140	1.512	0.383	
7	23.040	1.807	0.461	
8	26.060	2.180	0.521	
9	28.260	2.648	0.565	
10	31.720	3.270	0.634	
11	37.380	3.244	0.748	
12	39.060	3.548	0.781	
13	41.120	3.391	0.822	
14	42.980	3.000	0.860	
15	45.360	1.987	0.907	
16	47.600	0.881	0.952	
17	49.000	0.000	0.980	

Representação do grafo utilizado no estudo complementar



Bibliografia

Igraph Reference Manual –

<http://igraph.org/c/doc/igraph-docs.pdf>

Erdos-Renyi Model –

https://en.wikipedia.org/wiki/Erd%C5%91s%E2%80%93R%C3%A9nyi_model

Barabási-Albert Model –

https://en.wikipedia.org/wiki/Barab%C3%A1si%E2%80%93Albert_model