Trabalho Otimização em Grafos

Relatório: Checkpoints 2 e 3

Grupo IU1: Bruno Freire, Iuri Soares, Vinícius Teixeira

Link do Projeto: <https://github.com/iuriSoares/OtimizacaoGrafos20191>

Checkpoint 2:

Tempo de Execução:

|  |  |  |
| --- | --- | --- |
| Busca | | |
| Vertices(n) | Arestas(m) | Tempo de Execução |
| 3 | 2 | 0.0006995201110839844 |
| 5 | 4 | 0.0023889541625976562 |
| 6 | 6 | 0.0027620792388916016 |
| 7 | 5 | 0.0054950714111328125 |
| 8 | 7 | 0.0063099861145019531 |
| 9 | 9 | 0.0130243301391601562 |
| 10 | 8 | 0.0140869617462158203 |
| 20 | 18 | 0.0167078971862792969 |
| 50 | 41 | 0.0184488296508789062 |
| 100 | 4125 | 0.2194104194641113281 |
| 200 | 16562 | 1.1786642074584960938 |
| 500 | 107214 | 19.1516764163970947266 |
| 1000 | 422329 | 146.7471306324005126953 |

|  |  |  |
| --- | --- | --- |
| EhConexo | | |
| Vertices(n) | Arestas(m) | Tempo de Execução |
| 3 | 2 | 0.0027863979339599609 |
| 5 | 4 | 0.0001442432403564453 |
| 6 | 6 | 0.0001342296600341797 |
| 7 | 5 | 0.0010077953338623047 |
| 8 | 7 | 0.0039780139923095703 |
| 9 | 8 | 0.0004768371582031250 |
| 10 | 9 | 0.0012567043304443359 |
| 20 | 10 | 0.0037097930908203125 |
| 50 | 20 | 0.0040109157562255859 |
| 100 | 50 | 0.6239981651306152344 |
| 200 | 100 | 1.2799997329711914062 |
| 500 | 500 | 17.8960065841674804688 |
| 1000 | 1000 | 139.2823009490966796875 |

|  |  |  |
| --- | --- | --- |
| EhFloresta | | |
| Vertices(n) | Arestas(m) | Tempo de Execução |
| 3 | 2 | 0.0041337013244628906 |
| 5 | 4 | 0.0080130100250244141 |
| 6 | 6 | 0.0039660930633544922 |
| 7 | 5 | 0.0001344680786132812 |
| 8 | 7 | 0.0039911270141601562 |
| 9 | 9 | 0.0039927959442138672 |
| 10 | 8 | 0.0039992332458496094 |
| 20 | 18 | 0.0020713806152343750 |
| 50 | 41 | 0.0719916820526123047 |
| 100 | 4125 | 0.3040373325347900391 |
| 200 | 16562 | 1.2240438461303710938 |
| 500 | 107214 | 17.8720090389251708984 |
| 1000 | 422329 | 138.2779207229614257812 |

|  |  |  |
| --- | --- | --- |
| EhArvore2 | | |
| Vertices(n) | Arestas(m) | Tempo de Execução |
| 3 | 2 | 0.0137076377868652344 |
| 5 | 4 | 0.0108468532562255859 |
| 6 | 6 | 0.0145483016967773438 |
| 7 | 5 | 0.0119287967681884766 |
| 8 | 7 | 0.0026345252990722656 |
| 9 | 9 | 0.0000450611114501953 |
| 10 | 8 | 0.0031795501708984375 |
| 20 | 18 | 0.0054655075073242188 |
| 50 | 41 | 0.0021560192108154297 |
| 100 | 4125 | 0.2062160968780517578 |
| 200 | 16562 | 1.1318621635437011719 |
| 500 | 107214 | 16.8922700881958007812 |
| 1000 | 422329 | 139.4681468009948730469 |

|  |  |  |
| --- | --- | --- |
| Busca Completa | | |
| Vertices(n) | Arestas(m) | Tempo de Execução |
| 3 | 2 | 0.0057537555694580078 |
| 5 | 4 | 0.0112061500549316406 |
| 6 | 6 | 0.0064556598663330078 |
| 7 | 5 | 0.0097954273223876953 |
| 8 | 7 | 0.0126228332519531250 |
| 9 | 9 | 0.0150787830352783203 |
| 10 | 8 | 0.0296974182128906250 |
| 20 | 18 | 0.0153343677520751953 |
| 50 | 41 | 0.0149569511413574219 |
| 100 | 4125 | 0.1041517257690429688 |
| 200 | 16562 | 0.5294649600982666016 |
| 500 | 107214 | 6.7924823760986328125 |
| 1000 | 422329 | 53.4854540824890136719 |

|  |  |  |
| --- | --- | --- |
| Busca em Profundidade | | |
| Vertices(n) | Arestas(m) | Tempo de Execução |
| 3 | 2 | 0.0043840408325195312 |
| 5 | 4 | 0.0028197765350341797 |
| 6 | 6 | 0.0007557868957519531 |
| 7 | 5 | 0.0064990520477294922 |
| 8 | 7 | 0.0044884681701660156 |
| 9 | 9 | 0.0040457248687744141 |
| 10 | 8 | 0.0037908554077148438 |
| 20 | 18 | 0.0030121803283691406 |
| 50 | 41 | 0.0027968883514404297 |
| 100 | 4125 | 0.0033628940582275391 |
| 200 | 16562 | 0.0018613338470458984 |
| 500 | 107214 | 0.0242192745208740234 |
| 1000 | 422329 | 0.0039107799530029297 |

|  |  |  |
| --- | --- | --- |
| Tem Ciclo | | |
| Vertices(n) | Arestas(m) | Tempo de Execução |
| 3 | 2 | 0.0158233642578125000 |
| 5 | 4 | 0.0109875202178955078 |
| 6 | 6 | 0.0141093730926513672 |
| 7 | 5 | 0.0102097988128662109 |
| 8 | 7 | 0.0147559642791748047 |
| 9 | 9 | 0.0171015262603759766 |
| 10 | 8 | 0.0027060508728027344 |
| 20 | 18 | 0.0070047378540039062 |
| 50 | 41 | 0.0143294334411621094 |
| 100 | 4125 | 0.1028428077697753906 |
| 200 | 16562 | 0.4382541179656982422 |
| 500 | 107214 | 7.1101236343383789062 |
| 1000 | 422329 | 61.2267811298370361328 |

|  |  |  |
| --- | --- | --- |
| EhArvore | | |
| Vertices(n) | Arestas(m) | Tempo de Execução |
| 3 | 2 | 0.0256083011627197266 |
| 5 | 4 | 0.0168526172637939453 |
| 6 | 6 | 0.0128204822540283203 |
| 7 | 5 | 0.0142498016357421875 |
| 8 | 7 | 0.0022962093353271484 |
| 9 | 9 | 0.0197653770446777344 |
| 10 | 8 | 0.0027606487274169922 |
| 20 | 18 | 0.0073974132537841797 |
| 50 | 41 | 1.0134017467498779297 |
| 100 | 4125 | 0.1112287044525146484 |
| 200 | 16562 | 0.4960122108459472656 |
| 500 | 107214 | 7.1838347911834716797 |
| 1000 | 422329 | 54.0994732379913330078 |

|  |  |  |
| --- | --- | --- |
| ObterFlorestaGeradora | | |
| Vertices(n) | Arestas(m) | Tempo de Execução |
| 3 | 2 | 0.0227994918823242188 |
| 5 | 4 | 0.0241346359252929688 |
| 6 | 6 | 0.0250031948089599609 |
| 7 | 5 | 0.0058834552764892578 |
| 8 | 7 | 0.0192644596099853516 |
| 9 | 9 | 0.0083193778991699219 |
| 10 | 8 | 0.0009615421295166016 |
| 20 | 18 | 0.0037655830383300781 |
| 50 | 41 | 0.0296652317047119141 |
| 100 | 4125 | 0.1024086475372314453 |
| 200 | 16562 | 0.6391873359680175781 |
| 500 | 107214 | 7.7337145805358886719 |
| 1000 | 422329 | 56.9595980644226074219 |

|  |  |  |
| --- | --- | --- |
| Busca Profundidade Recursivo | | |
| Vertices(n) | Arestas(m) | Tempo de Execução |
| 3 | 2 | 0.0005576610565185547 |
| 5 | 4 | 0.0104229450225830078 |
| 6 | 6 | 0.0037245750427246094 |
| 7 | 5 | 0.0125668048858642578 |
| 8 | 7 | 0.0047972202301025391 |
| 9 | 9 | 0.0020742416381835938 |
| 10 | 8 | 0.0015900135040283203 |
| 20 | 18 | 0.0020484924316406250 |
| 50 | 41 | 0.0016484260559082031 |
| 100 | 4125 | 0.0050134658813476562 |
| 200 | 16562 | 0.0062155723571777344 |
| 500 | 107214 | 0.0008151531219482422 |
| 1000 | 422329 | 0.0179619789123535156 |

|  |  |  |
| --- | --- | --- |
| Busca Largura | | |
| Vertices(n) | Arestas(m) | Tempo de Execução |
| 3 | 2 | 0.0021162033081054688 |
| 5 | 4 | 0.0039770603179931641 |
| 6 | 6 | 0.0079810619354248047 |
| 7 | 5 | 0.0010719299316406250 |
| 8 | 7 | 0.0016138553619384766 |
| 9 | 9 | 0.0029070377349853516 |
| 10 | 8 | 0.0044956207275390625 |
| 20 | 18 | 0.0016455650329589844 |
| 50 | 41 | 0.0028505325317382812 |
| 100 | 4125 | 0.0315344333648681641 |
| 200 | 16562 | 0.2153027057647705078 |
| 500 | 107214 | 3.5420839786529541016 |
| 1000 | 422329 | 28.7291150093078613281 |

|  |  |  |
| --- | --- | --- |
| Determinar Distancias | | |
| Vertices(n) | Arestas(m) | Tempo de Execução |
| 3 | 2 | 0.0035028457641601562 |
| 5 | 4 | 0.0150475502014160156 |
| 6 | 6 | 0.0001485347747802734 |
| 7 | 5 | 0.0124316215515136719 |
| 8 | 7 | 0.0116863250732421875 |
| 9 | 9 | 0.0042610168457031250 |
| 10 | 8 | 0.0044016838073730469 |
| 20 | 18 | 0.0040068626403808594 |
| 50 | 41 | 0.0047857761383056641 |
| 100 | 4125 | 0.0444459915161132812 |
| 200 | 16562 | 0.2001709938049316406 |
| 500 | 107214 | 3.4016921520233154297 |
| 1000 | 422329 | 27.9150922298431396484 |

Checkpoint 3 - Caminhos Mínimos

Para a implementação de caminhos míminos, utilizamos o algoritmo de Dijkstra pela facilidade na implementação e desempenho.

Nesse checkpoint, utilizamos a função vizinhos, criada no checkpoint 1 para descobrir os vizinhos dos vertices quando necessário.

Criamos uma matriz w que computa os pesos das arestas existentes no grafo e colocamos esses pesos randomicamente na execução da função.

As arestas não existentes ficam com valor Nulo em seus pesos.

Tempo do algoritmo: ?(n^2)

|  |  |  |
| --- | --- | --- |
| Caminho mínimo | | |
| Vertices(n) | Arestas(m) | Tempo de Execução |
| 3 | 2 | 0 |
| 5 | 4 | 0 |
| 6 | 6 | 0 |
| 7 | 5 | 0 |
| 8 | 7 | 0 |
| 9 | 9 | 0 |
| 10 | 8 | 0 |
| 20 | 18 | 0 |
| 50 | 41 | 0.00399375000 |
| 100 | 4125 | 0.18411350251 |
| 200 | 16562 | 1.20684981300 |
| 500 | 107214 | 17.9614803790 |
| 1000 | 422329 | 125.622499228 |