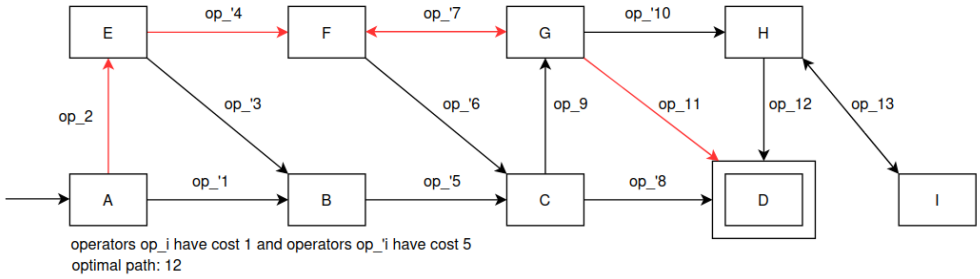
Lista 4 - Inteligência Artificial Avançada INF05004

Henrique Lorentz Trein
00341853
henrique.trein@ufrgs.br

Junho 2025

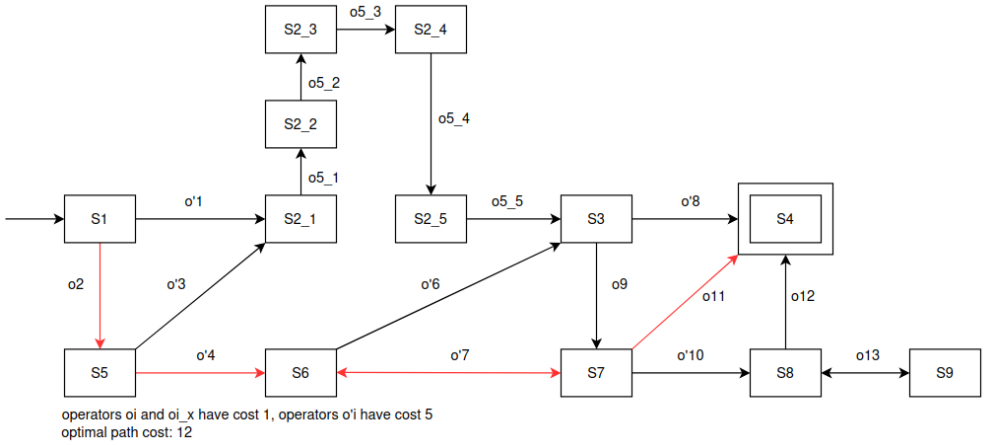
1

(a) a graph G1 which is isomorphic to G but not the same.



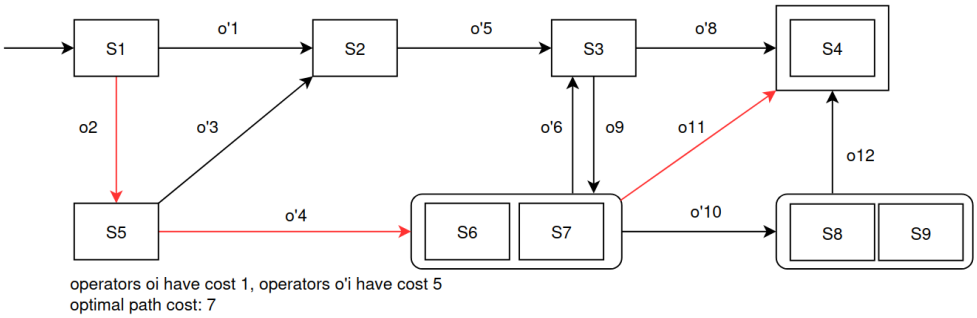
Graph G1 is isomorphic to G because there exists a one-to-one correspondence between their vertices and edges that preserves adjacency and edge costs.

(b) a graph G2 which is graph equivalent to G but not isomorphic to it.



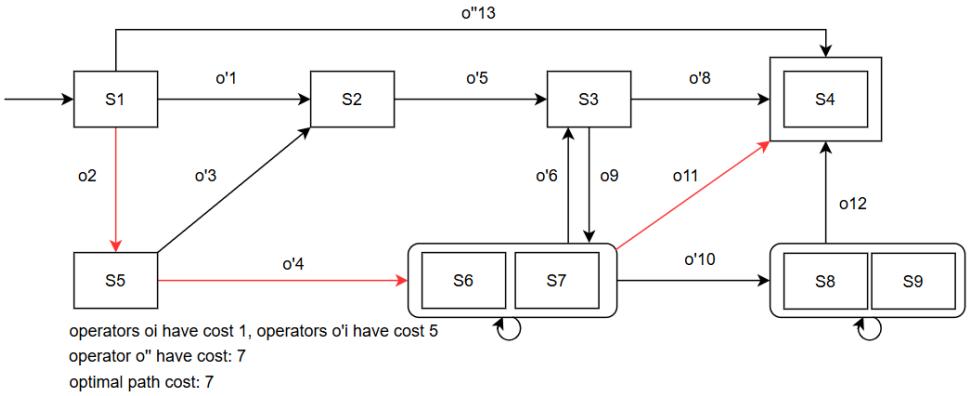
Graph G2 is equivalent to G in terms of state reachability and path costs, but it is not isomorphic to G because there is no bijective mapping between their edges. This means G2 have a different structure.

(c) a graph G3 which is a strict homomorphism of G but not graph equivalent to it.



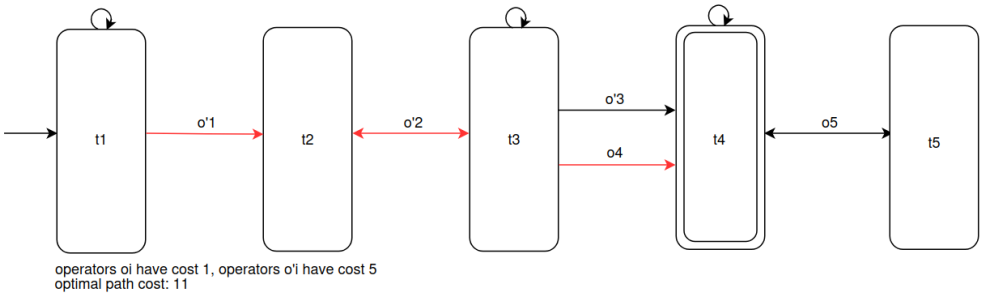
Graph G3 is a strict homomorphism of G because it has some collapsed states. However, G3 is not graph equivalent to G because the homomorphism introduces ambiguity, paths in G that pass through collapsed states become indistinguishable in G3.

(d) a graph G4 which is a non-strict homomorphism of G but not graph equivalent to it.



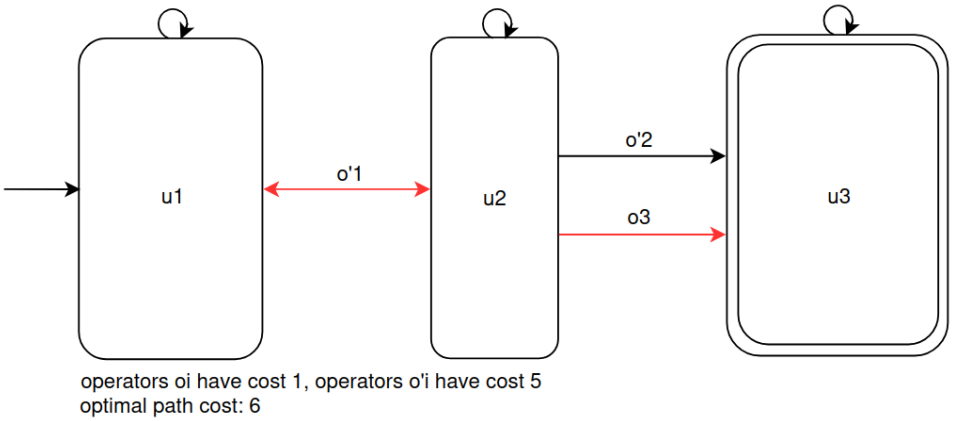
Graph G4 is a non-strict homomorphism of G formed by collapsing states in G and introducing new structural feature, such as loops between the collapsed states and edges whose costs match the total cost of corresponding paths in G. However, G4 is not graph equivalent to G because the homomorphism introduces ambiguity, paths in G that pass through collapsed states become indistinguishable in G4.

(e) a graph G5 that is the transition system induced by the abstraction α that maps states that are in the column i in the image above to the abstract state si. For example, the two states in the first column are mapped to an abstract state t1, the two states in the second column to an abstract state t2, and so on.



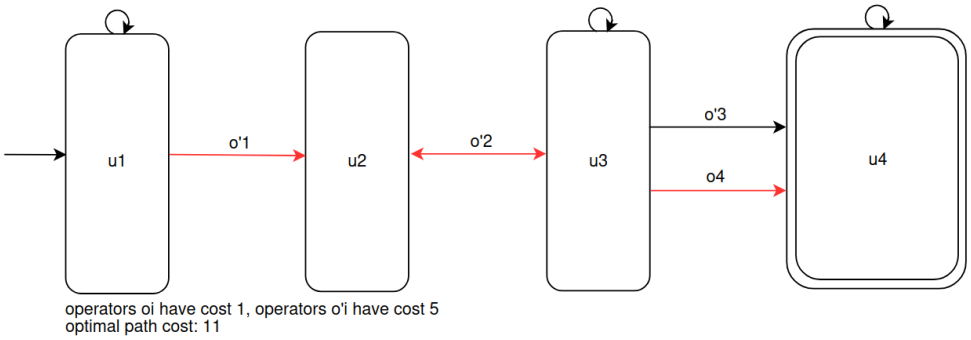
G5 is an abstraction of G because it merges concrete states into abstract states while preserving the start and goal states and all feasible paths in G. The abstraction reduces the state space, but may introduce additional paths not present in the original graph G.

(f) graph G6 that is the induced transition system of an abstraction β that is a non-trivial coarsening of α.



G6 is a coarsening of α because it merges multiple abstract states of α into fewer, higher-level states, resulting in a graph with fewer nodes.

(g) a graph G7 that is the induced transition system of an abstraction γ that is a non-trivial refinement of β but different from α.



G7 is a refinement of β but different from α because it takes G6 and splits one abstract state into two finer states but still has one less abstract state than α.

2

Inst.	k	Built-in			PlanOpt		
		Exp.	Search (s)	Total (s)	Exp.	Search (s)	Total (s)
1	1000	943 826	4.424 353	4.457 238	943 826	4.683 070	4.715 875
2	1000	6 173 897	28.489 807	28.513 475	6 173 897	30.616 732	30.652 934
3	1000	2 284 135	11.041 830	11.079 869	2 284 135	11.526 330	11.569 610
4	1000	3718	0.015 964	0.043 914	3718	0.015 432	0.056 103
5	1000	2 083 481	9.899 735	9.927 014	2 083 481	9.050 854	9.085 184
7	1000	1 212 763	6.279 156	6.309 217	1 212 763	6.030 910	6.070 430
8	1000	2 191 432	8.142 075	8.168 178	2 191 432	8.558 267	8.594 373
9	1000	591 954	2.861 611	2.888 598	591 954	2.952 509	2.987 937
10	1000	744	0.003 999	0.028 135	744	0.004 000	0.040 074
11	1000	1 377 703	6.274 891	6.300 601	1 377 703	6.565 093	6.598 007
13	1000	6742	0.028 038	0.063 145	6742	0.023 985	0.061 072
14	1000	20 956	0.072 000	0.097 862	20 956	0.084 004	0.122 449
16	1000	3 182 046	15.643 438	15.670 407	3 182 046	16.077 517	16.114 954
17	1000	5 635 414	27.040 702	27.066 666	5 635 414	28.835 301	28.875 325
18	1000	23 009	0.071 979	0.099 076	23 009	0.063 965	0.100 284
20	1000	106	0.000 000	0.030 445	106	0.000 000	0.036 706
1	100000	163 463	0.715 982	0.780 647	163 463	0.935 878	3.201 653
2	100000	2 077 437	9.062 695	9.121 986	2 077 437	8.407 127	10.310 130
3	100000	691 046	2.944 942	2.994 934	691 046	3.673 197	5.603 470
4	100000	3718	0.015 984	0.076 664	3718	0.011 982	2.059 844
5	100000	1 085 453	4.538 357	4.597 049	1 085 453	4.732 100	6.642 116
7	100000	349 735	1.778 836	1.832 960	349 735	1.843 430	3.760 264
8	100000	1 158 937	4.359 375	4.408 301	1 158 937	4.016 208	5.965 860
9	100000	138 527	0.771 521	0.832 222	138 527	0.956 302	3.290 714
10	100000	744	0.003 998	0.057 253	744	0.000 000	2.036 362
11	100000	314 669	1.342 557	1.393 098	314 669	1.443 269	3.358 631
13	100000	6742	0.019 992	0.075 708	6742	0.024 002	2.289 447
14	100000	20 966	0.076 018	0.133 002	20 966	0.073 780	2.314 452
16	100000	698 947	4.127 077	4.188 149	698 947	4.295 223	6.650 090
17	100000	1 045 506	5.975 606	6.026 135	1 045 506	5.804 918	8.060 154
18	100000	22 996	0.079 863	0.143 936	22 996	0.075 632	2.365 021
20	100000	106	0.004 004	0.056 136	106	0.000 000	2.005 761

Inst.	k	Built-in			Built-in PDB			PlanOpt		
		Exp.	Search (s)	Total (s)	Exp.	Search (s)	Total (s)	Exp.	Search (s)	Total (s)
1	1000	43	0.000 000	0.005 253	43	0.000 000	0.004 183	43	0.000 000	0.005 331
2	1000	2406	0.006 558	0.014 664	10 405	0.015 742	0.023 795	2406	0.003 117	0.011 143
3	1000	2231	0.006 182	0.013 076	31 011	0.053 739	0.059 924	2231	0.004 525	0.010 735
4	1000	31 350	0.078 655	0.088 893	1 379 615	2.861 466	2.871 270	31 350	0.087 995	0.098 506
5	1000	391 698	1.278 120	1.298 026	-	-	-	391 698	1.792 831	1.813 321
6	1000	3 323 144	15.168 941	15.215 360	-	-	-	3 323 144	17.780 021	17.812 364
7	1000	-	-	-	-	-	-	-	-	-