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Galois connections between sets of paths and closure operators in simple graphs. (English)
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Summary: For every positive integer n,we introduce and discuss an isotone Galois connection between the sets of paths of lengths n in a simple graph and the closure operators on the (vertex set of the) graph. We consider certain sets of paths in a particular graph on the digital line $\mathbb{Z}$ and study the closure operators associated, in the Galois connection discussed, with these sets of paths. We also focus on the closure operators on the digital plane $\mathbb{Z}^2$ associated with a special product of the sets of paths considered and show that these closure operators may be used as background structures on the plane for the study of digital images.

MSC:

05C10 Planar graphs; geometric and topological aspects of graph theory
05C38 Paths and cycles
06A15 Galois correspondences, closure operators (in relation to ordered sets)

Keywords:

simple graph; closure operator; Galois connection; digital space; Khalimsky topology; Jordan curve theorem

Full Text: DOI

References:

[1] Khalimsky E.D., Kopperman R., Meyer P.R., Computer graphics and connected topologies on finite ordered sets, Topology Appl., 1990, 36, 1-17 · Zbl 0709.54017
[2] Šlapal J., Graphs with a path partition for structuring digital spaces, Inf. Sciences, 2013, 233, 305-312 · Zbl 1284.05310
[3] Harrary F., Graph Theory, Addison-Wesley Publ. Comp., Reading, Massachussets, Menlo Park, California, London, Don Mills, Ontario, 1969
[4] Sabidussi G., Graph multiplication, Math. Z., 1960, 72, 446-457 · Zbl 0093.37603
[5] Cech E., Topological spaces, In: Topological Papers of Eduard Cech, Academia, Prague, 1968, ch. 28, 436-472
[6] Cech E., Topological Spaces (revised by Z. Frolík and M. Katětov), Academia, Prague, 1966
[7] Kong T.Y, Kopperman R., Meyer P.R., A topological approach to digital topology, Amer. Math. Monthly, 1991, 98, 902-917 · Zbl 0761.54036
[8] Engelking R., General Topology, Panstwowe Wydawnictwo Naukowe, Warszawa, 1977
[9] Davey B.A., Priestley H.A., Introduction to Lattices and Order, Cambridge University Press, Cambridge, 2002 · Zbl 1002.06001
[10] Klette R., Rosenfeld A., Digital Geometry - Geometric Methods for Digital Picture Analysis, Elsevier, Singapore, 2006
[11] Brimkov V.E., Klette R., Border and surface tracing - theoretical foundations, IEEE Trans. Patt. Anal. Machine Intell., 2008, 30, 577-590
[12] Khalimsky E.D., Kopperman R., Meyer P.R., Boundaries in digital plane, J. Appl. Math. Stochast. Anal., 1990, 3, 27-55 · Zbl 0695.54017
[13] Šlapal J., Jordan curve theorems with respect to certain pretopologies on Z2 Lect. Notes in Comput. Sci., 2009, 5810, 252-262 · Zbl 1261.68118
[14] Šlapal J., Convenient closure operators on Z2 Lect. Notes in Comput. Sci., 2009, 5852, 425-436 · Zbl 1267.68257
[15] Šlapal J., A digital analogue of the Jordan curve theorem, Discr. Appl. Math., 2004, 139, 231-251 · Zbl 1062.54001