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Near-homogeneous spherical Latin bitrades

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Abstract: A planar Eulerian triangulation is a simple plane graph in which each face is a triangle and each vertex has even degree. Such objects are known to be equivalent to spherical Latin bitrades. (A Latin bitrade describes the difference between two Latin squares of the same order.) We give a classification in the near-regular case when each vertex is of degree 4 or 6 (which we call a near-homogeneous spherical Latin bitrade, or NHSLB). The classification demonstrates that any NHSLB is equal to two graphs embedded in hemispheres glued at the equator, where each hemisphere belongs to one of nine possible types, each of which may be described recursively.

Keywords: planar Eulerian triangulation; Latin bitrade; Latin square
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References

[1] Altshuler A., *Construction and enumeration of regular maps on the torus*, Discrete Math. **115** (1973), 201–217.
[2] Batagelj V., *An improved inductive definition of a restricted class of triangulations of the plane*, Combinatorics and Graph Theory (Warsaw, 1987), Banach Center Publ., 25, PWN, Warsaw, 1989, pp. 11–18.
[3] Brinkmann G., McKay B., *Guide to using plantri*, version 4.1 `http://cs.anu.edu.au/ bdm/plantri/`
[4] Cavenagh N., *The theory and application of Latin bitrades: a survey*, Math. Slovaca **58** (2008), 691–718.
[5] Cavenagh N., *A uniqueness result for* 3*-homogeneous Latin trades*, Comment. Math. Univ. Carolin. **47** (2006), 337–358.
[6] Cavenagh N., Lisonek P., *Planar Eulerian triangulations are equivalent to spherical Latin bitrades*, J. Combin. Theory Ser. A **115** (2008), 193–197.
[7] Colbourn C.J., Dinitz J.H., Wanless I.M., *Latin Squares*, in: The CRC Handbook of Combinatorial Designs, 2nd ed. (C.J. Colbourn and J.H. Dinitz, eds.), CRC Press, Boca Raton, FL, 2007, pp. 135–152.
[8] Drápal A., Griggs T.S., *Homogeneous Latin bitrades*, Ars Combin. **96** (2010), 343–351.
[9] Goodey P.R., *Hamiltonian circuits in polytopes with even sided faces*, Israel J. Math. **22** (1975), 52–56.
[10] Grannell M.J., Griggs T.S., Knor M., *Biembeddings of symmetric configurations and* 3*-homogeneous Latin trades*, Comment. Math. Univ. Carolin. **49** (2008), 411–420.
[11] Grünbaum B., *Convex Polytopes*, John Wiley, New York, 1967.
[12] Holton D.A., Manvel B., McKay B.D., *Hamiltonian cycles in* 3*-connected bipartite planar graphs*, J. Combin. Theory Ser. B **38** (1985), 279–297.
[13] Lovász L., *Combinatorial Problems and Exercises*, 2nd edition, North-Holland, Amsterdam, 1993.
[14] Negami S., *Uniqueness and faithfulness of embedding of toroidal graphs*, Discrete Math. **44** (1983), 161–180.
[15] Saaty T.L., Kainen P.L., *The Four-Colour Problem: Assaults and Conquests*, McGraw-Hill, New York, 1977.
[16] Tutte W.T. (Ed.), *Recent Progresses in Combinatorics*, Academic Press, New York, 1969, p. 343.
[17] Wanless I., *A computer enumeration of small Latin trades*, Australas. J. Combin. **39** (2007), 247–258.