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CONSTRUCTIVE ENUMERATION OF GRAPHS

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The production of exhaustive catalogues of small graphs is an integral part of graph theoretic research effort. This thesis considers two different types of graph, and devises construction methods that were used to extend the range of the existing catalogues. The first half of the thesis concentrates on cubic graphs. An orderly algorithm is devised for the construction of cubic graphs and used to construct all the cubic graphs on up to 20 vertices. Two applications of this catalogue are given. The first of these applications is to a problem concerning cycles through 11 vertices in 3-connected cubic graphs which is solved only with the aid of the catalogue. The second application is that of finding all the snarks on up to 22 vertices. The composition of these snarks in terms of the known infinite families is briefly described.

The remaining chapters are devoted to the construction of vertex-transitive graphs. The existing catalogue of all the vertex-transitive graphs on 19 vertices is extended to 24 vertices. The construction of the vertex-transitive graphs on up to 23 vertices is accomplished with the aid of a simple group theoretic result. The construction of those on 24 vertices is considerably more difficult and requires some deeper group theory and the use of sophisticated group theoretic software such as CAYLEY. A further tool necessary for this construction is a list of all the transitive groups of degree 12, and the production of this list is also described. Finally, the thesis contains much numerical information, including numbers of cubic graphs with specific properties, numbers of Cayley graphs on up to 31 vertices, lists of G-CI groups of order up to 31, and complete listings of all the non-Cayley graphs on 20-24 vertices.

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