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Dr. Donald W. Grace
Procter & Gamble Co.
Ivorydale Technical Center
Cincinnati 17, Ohio

Dear Dr. Grace:

I am very sorry to have learned about your work on polyhedra only after you left. Surprisingly enough, it has a distinct bearing on chemistry, as I can perhaps best explain by referring immediately to the enclosures.

Especially as regards the note on Hamilton circuits, the extension to larger graphs is of greater academic than practical concern. However,having once gotten started in this direction, I find it rather irritating not to have a deeper insight than I do into the enumeration of these graphs generally. I am looking forward to Professor Polya's return as a probable help. (He chose the wrong year to go away or I ~~x~~to work on such problems.)

I wanted to ask you whether you might be interested to continue your analysis on some of these problems. For example, the exploration of the Hamilton circuits in the range n_{14}- n_{18} (i.e. n vertices) might recheck the isomorphisms. Thus, one might use the face-dissection program to generate only non-trigonal forms, viz., by avoiding adjacent edges, ~~and using only non-trigonal parents~~ (I have to strike that out since a trigonal parent can generate a non-trigonal offspring:: needless to say, since one starts with the tetrahedron). Trigonal forms are probably most efficiently generated as combinations of the ways that the vertices of the lower order graphs can be marked for expansion into triangles. This can also be turned into a test for isomorphism (via the Hamilton circuit of the reduced figure, marked). As you will see, all the polyhedra in your main list (up to n_{18}) do have Hamilton circuits provided the equisurroundness criterion holds through n_{16}.

Another proposal might be check Tait's conjecture through n_{20} by using your program through one more step, but saving only non-trigonal forms. This would entail using the non-trigonal n_{18}'s and avoiding adjacent edges there; and also the mono-trigonal n_{18}'s in just the fashion to enlarge the triangle. To go to n_{22} may be difficult but not impossible, as one would have to build all the mono-trigonal n_{20}'s as well as the foregoing. But this can be done merely by marking one vertex all possible ways on the nontrigonal n_{18}'s.

This is rather tiresome to have to deal with by letter. George Forsythe thought it might be reasonable to ask you whether you had any interest in returning briefly to Stanford at some convenient time that we might discuss these problems and perhaps consider some further runs.

Meanwhile, I wonder if you can spare another copy of your thesis, which is in short supply here; also the reproduction of the listings is not all it could be. If you should happen to have card-deck or tape storage of your output tables, it might be especially helpful.

Sincerely,

Joshua Lederberg