A Note on "A Note on 'Some Simplified NP-Complete Graph Problems'"

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In a recent issue of SIGACT NEWS, Krishnamoorthy [4] makes two observations concerning the degree bounds under which the directed Hamiltonian circuit problem remains NP-complete, based on results in our paper [3] with L. Stockmeyer. Unfortunately, the more significant of these observations is incorrect.

In [3] we state that the largest degree bounds for which we know this problem to be easy are 2-In, 1-Out or 2-Out, 1-In. (In fact the problem is easy whenever all vertices have in-degree 1 or all vertices have out-degree 1.) However, it should not be inferred that the problem is easy for the mixed case in which each vertex satisfies one or the other of these bounds, which indeed would imply that the 2-In, 2-Out case is easy.

Moreover, in a joint effort with J. Seiferas [2] we have been able to prove that the 2-In, 2-Out case is NP-complete, even for planar digraphs. The proof is a modification of that given in [1] for the NP-completeness of the Euclidean traveling salesman problem. It follows, using the standard vertex-splitting argument reiterated in [4], that the mixed 2-In, 1-Out and 2-Out, 1-In case is also NP-complete. The vertex-splitting procedure does not preserve planarity, however, so the difficulty of finding a Hamiltonian circuit in a planar digraph in which at most 3 arcs are incident with any vertex remains open.

1. M. R. Garey, R. L. Graham, and D. S. Johnson, "Some NP-Complete Geometric Problems", STOC 8 (1976), 10-22.

2. M. R. Garey, D. S. Johnson, and J. Seiferas, "A Note on 'A Note on 'A Note on 'Some Simplified NP-Complete graph Problems'''", in preparation.

3. M. R. Garey, D. S. Johnson, and L. Stockmeyer, "Some Simplified NP-Complete Graph Problems", Theoretical Computer Science 1 (1976), 237-267.

4. M. S. Krishnamoorthy, "A Note on 'Some Simplified NP-Complete Graph Problems'", SIGACT NEWS 9 (1977), No. 3, 24.