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Department of Mathematics C012
University of California
La Jolla, CA 92093

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Professor Eugene L. Lawler
Computer Science Division
University of California
Berkeley, CA 94720

Dear Professor Lawler:

The fine historical chapter on the TSP by Alan Hoffman is completely accurate where it refers to developments within my direct experience. It is a pity that I cannot find the letter from my old friend Hassler Whitney in which he denies any knowledge of the TSP and also offers some rather naive suggestions for approaching it. I probably still have his letter but my files are in storage and disarray at the moment.

My own contributions in the TSP area, other than the ones referred to by Alan, are identified next for the record. I suppose I am writing at some length partly to fulfill a task that has faced me for some years, that of digging into my files and memory as needed to record my recollections about the history of this fascinating problem.

1) Ray Fulkerson was one of my key research assistants at RAND and he and I discussed the TSP many times during the period 1950-52. Stimulated by Julia Robinson's RAND Research Memorandum that showed very clearly the relationships between the assignment problem, the transportation problem, and the traveling salesman problem Ray and I obtained many partial results regarding the TSP but nothing we judged worthy of publication. On October 21, 1955 in New York at the second TIMS meeting Ray asked me how I would try to solve a large TSP if I needed to do so and I outlined the branch and bound procedure under what I called the "loop eliminatio" procedure. I was of course then aware of the Dantzig, Fulkerson, Johnson paper but had hit upon the loop elimination idea presented in my paper entitled "Operations Research and Logistics" presented on 14 May 1954 at Frankford Arsenal and published in the Proceedings of the First Ordnance Conference on Operations Research. It was published again, with minor revision, in the Naval Logistics Research Quarterly, December 1958, pp. 37-49. As I note in a footnote I learned about the Dantzig, Fulkerson, Johnson paper after my Frankford Arsenal talk. Alan refers to my 1956 paper on the TSP, which I presented on 16 February 1955 at Johns Hopkins University, in which I include a synopsis and application of the DFJ procedure using cutting planes.

2) I urged my graduate students at Columbis University during the period 1953-56 to solve the TSP and to develop important applications for it as a scheduling model. One of my students, I believe it was Lew Vinton, presented such an application at one of my seminars and I report upon this application in my 1954 and 1958 papers. Vinton's idea was the first substantial one that came to my attention regarding applications of the TSP other than those like the one proposed originally by Whitney in 1934. I also recall that George Feeney, another of my Columbia seminar students, worked with his friend Lew Vinton on the application.

3) Perhaps the most interesting historical fact never yet reported so far as I know relates to my exchange of correspondence with Eastman about his dissertation research as a graduate student in geography (economics) at Harvard. He sent me a working copy of an early version of his doctoral dissertation, which I returned showing that his then proposed algorithm for the TSP was strictly enumerative. I also outlined for him my loop elimination procedure. I do not recall hearing from him again after that, nor have I ever seen his final dissertation, but Ralph Gomory told me years later that the final version dropped the original approach and used what Little et al later labelled the "branch and bound" approach.

4) Not until 1967-68 did I have the opportunity to program my loop elimination approach for test runs on a good computer --- the Q32 at the System Development Corporation in Santa Monica. I recall running many test problems of size 100 or so, with a few solved quickly of course but a few taking very very long on the Q32. I asked Ray Fulkerson for a tough problem to try out my Q32 program and he referred me to one of size 30 or so in a book by Tutte. My Q32 program was so bad on the Tutte problem that I abandoned further testing and spent my research time looking for improvements on my algorithm. I happened to visit with Dick Karp at Berkeley at this time and told him about my Q32 failure with the Tutte problem. He said he would give it a try with his method and I learned several weeks later from Dick via a mutual friend that Dick's program had handled the Tutte problem very neatly. That fact, together with a complete change in my employment responsibilities, terminated my effort on the TSP. Now I simply follow with complete admiration the beautiful work by Dick Karp and many others on the TSP.

5) As an aside, I have been seeking better procedures for "solving" quadratic assignment problems off and on during the past seven years. I need these for an application in the area of social choice. I am dismayed at the prospect of using branch and bound methods even for rather small problems. So I will continue to watch others and hope for help from some quarter eventually with the quadratic assignment problem, and related problems that Dick Karp has shown us conclusively are indeed HARD.

Again, I compliment Alan Hoffman on his fine chapter and look forward eagerly to the publication of your book on the TSP. If you have an early draft for distribution I would of course welcome the opportunity to read it and comment if I have anything useful to say.

Best regards.

Sincerely,

Merrill M. Flood

Merrill M. Flood
Visiting Research Mathematician

Cc: A.W. Tucker

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