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**A Historical Note on Shell Sort,
Bresenham's Algorithm, and the
Chinese Postman Problem**

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Abstract

Some historical notes on the proper name of Shell sort, the spread and first publication of Bresenham's algorithm, and the genesis of the name of the Chinese postman problem.

Key words

Computer science history; Shell sort; Bresenham's algorithm; Chinese postman problem.

Table of Contents

1	Introduction	1
2	The Notes	1
2.1	The Proper Name of Shell Sort	1
2.2	Spread of Bresenham's Algorithm	2
2.3	The Genesis of the Name of the Chinese Postman Problem	2
	References	2

1. Introduction

As the editor of the online Dictionary of Algorithms and Data Structures [1], I have received historical background from those involved in computer science. I want to publish some of these to preserve the knowledge.

The first two are emails in the author's words with minimal editing. I have not verified that emails originated with the claimed author, but I see no reason to doubt them.

2. The Notes

2.1 The Proper Name of Shell Sort

Shell sort [2] was improperly called the Shell-Metzner sort by John P. Grillo, *A Comparison of Sorts*, Creative Computing, 2:76-80, Nov/Dec 1976. Grillo cites Fredric Stuart, *FORTRAN Programming*, John Wiley and Sons, New York, 1969, page 294. In crediting "one of the fastest" programs for sorting, Stuart says in a footnote, "Published by Marlene Metzner, Pratt & Whitney Aircraft Company. From a method described by D. L. Shell."

In April 2003 Marlene Metzner Norton wrote:

I had nothing to do with the sort, and my name should never have been attached to it. So, here's the scoop.

I graduated from college in 1956 with a degree in Math. The math I took for a college degree in 1956 is pretty much all taught in high school now. I applied for a job at GE in Evendale, Cincinnati. (It was that or teach high school.) They put me to work programming an IBM 704 in an assembly language called CAGE. I don't remember what it stood for, but the GE was General Electric. Probably "Computer Assembler by General Electric". Don Shell worked in the same building, but he was manager of the Systems Analysts. I was one of the many who got several pages of equations and turned them into code that would run via punched cards. This was before Basic and Fortran. The Systems Analysts wrote assemblers, ways to create buffers to make printing faster, etc. I doubt that Don Shell even knew who I was. About 1959 we started using Fortran – just a little.

I think Don Shell wrote up the theory of his sorting method for the Computing Dept. newsletter. I thought it was interesting and held on to a copy.

In 1960, I bought a convertible and moved to Florida. Why? I was young, single, the field was wide open and Florida sounded like fun. Accepted a job at Pratt & Whitney in West Palm Beach. Did the same kind of programming, but Pratt had a brand new IBM 7090. They programmed in SAP. It was similar to CAGE. The logic was the same, but the instruction names differed just enough to be confusing.

Somewhere around 1961 or so, Pratt got an IBM 1620. This was a much smaller computer using punched paper tape instead of cards. Colleges used it for teaching computers. Pratt used it in the Engineering Dept. so engineers could handle smaller problems on their own instead of bringing them to the Computer Lab. I was put in charge of co-ordinating the 1620 in Engineering with the Computer Dept. IBM started a 1620 USER's group. I was

sent to the first meeting. Being the only woman there, I was naturally voted in as Secretary-Treasurer. Within the first year, a company in Germany bought one so now it was the IBM 1620 INTERNATIONAL USER'S GROUP.

The User's Group put out a Newsletter. People wrote in with questions, suggestions, ideas, etc. To help fill up one of the earlier editions, I pulled out Don Shell's sort method and coded it in Fortran. Took about 10 lines of code, give or take five, and an equal amount of time. Gave Don Shell complete credit.

Marlene

2.2 Spread of Bresenham's Algorithm

In November 2001 Jack E. Bresenham wrote:

I was working in the computation lab at IBM's San Jose development lab. A Calcomp plotter had been attached to an IBM 1401 via the 1407 typewriter console. [The algorithm] [3] was in production use by summer 1962, possibly a month or so earlier. Programs in those days were freely exchanged among corporations so Calcomp (Jim Newland and Calvin Hefte) had copies. When I returned to Stanford in Fall 1962, I put a copy in the Stanford comp center library.

A description of the line drawing routine was accepted for presentation at the 1963 ACM national convention in Denver, Colorado. It was a year in which no proceedings were published, only the agenda of speakers and topics in an issue of Communications of the ACM. A person from the IBM Systems Journal asked me after I made my presentation if they could publish the paper. I happily agreed, and they printed it in 1965.

2.3 The Genesis of the Name of the Chinese Postman Problem

A 1962 article [4] referred to optimizing a postman's route. Since it was written by a Chinese author and appeared in a Chinese math journal, Alan J. Goldman suggested the name "Chinese postman problem" [5] to Jack Edmonds when Edmonds was in Goldman's Operations Research group at the U.S. National Bureau of Standards (now NIST) [6]. Edmonds appreciated its "catchiness" and adopted it. Goldman said he was also slightly influenced by recalling Ellery Queen's *The Chinese Orange Mystery* [7].

References

- [1] Dictionary of Algorithms and Data Structures, Paul E. Black, ed., <https://doi.org/10.18434/T4/1422485>. Accessed: 21 April 2020.
- [2] Black PE, Kagel AS (2022) Shell sort, in *Dictionary of Algorithms and Data Structures*, Paul E. Black, ed., <https://www.nist.gov/dads/HTML/shellsort.html>. Accessed 4 April 2022.
- [3] Black PE (2020) Bresenham's algorithm, in *Dictionary of Algorithms and Data Structures*, Paul E. Black, ed., <https://www.nist.gov/dads/HTML/bresenham.html>. Accessed 4 April 2022.

- [4] Kwan MK (1962) Graphic programming using odd or even points. *Chinese Math* 1:273–277.
- [5] (1999) *Algorithms and Theory of Computation Handbook* (CRC Press LLC), .
- [6] Goldman AJ (2003), personal communication.
- [7] Queen E (1934) *The Chinese Orange Mystery* (Stokes Pub Co).