

Collaborative Research: Learning Discrete Mathematics and Computer Science via Primary Historical Sources

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<http://www.cs.nmsu.edu/historical-projects>

1 Historical Projects we plan to develop

- **Networks and Spanning Trees.** Trees arise today in computer science as those graphs with the least number of edges that connect a given set of vertices. In this project the development of the idea of a *tree* is studied from the original paper of Heinz Prüfer (1896–1934) “A New Proof of a Theorem on Permutations,” in 1918 [57]. Prüfer introduces the notion of a graph network to describe a net of railway connections between n -many towns in which the least possible number of connections is used, and describes several properties of this network which today have been realized as theorems about trees. Furthermore, he counts all such networks, calling the various possibilities “permutations,” which in fact enumerate all labeled trees with n vertices. The project will explore Prüfer reduction of the railway problem to a combinatorial question about what today are called graphs, and investigate properties of trees identified by Prüfer. The module is designed for courses covering graph theory, trees, and minimal spanning trees. Primary Author: PI Jerry Lodder.