

# Mixed-Integer Nonlinear Programming Model for the Close-Enough Traveling Salesman Problem

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## Overview

In this optimization problem we develop a model to find the minimum distance set of Hamiltonian cycles originating at a single depot and traveling through a set of nodes where at least one tour must get within a specified distance of each node in order to visit it. The model simultaneously determines which nodes are given to which vehicle, the sequence of nodes in each cycle, and the location at which each node is visited[1].

A mixed-integer nonlinear programming (MINLP) formulation of this problem is presented. It is a nonconvex MINLP with a nonconvex objective function, a convex quadratic constraint corresponding to each node, a nonconvex quadratic constraint corresponding to each edge, and integer linear vehicle routing constraints.

## References

- [1] W. Mennell. *Heuristics for solving three routing problems: Close-Enough Traveling Salesman Problem, Close-Enough Vehicle Routing Problem, Sequence-Dependent Team Orienteering Problem*. PhD thesis, University of Maryland, College Park, 2009.