Supplement to *Methods for Solving the p-Median Problem: An Annotated Bibliography*

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This is a supplement to *Methods for Solving the p-Median Problem: An Annotated Bibliography* that contains references to all of the papers considered for that work. The papers referenced here either 1) were included in the annotated bibliography, 2) did not fit the criteria of inclusion, or 3) could not be obtained.

References

[1] P. K. Agarwal and M. Sharir. Efficient algorithms for geometric optimization. *ACM Computing Surveys*, 30(4):412–458, 1998.

[2] S. Ahn, C. Cooper, G. Cornuéjols, and A. M. Frieze. Probabilistic analysis of a relaxation for the k-median problem. *Mathematics of Operations Research*, 13(1):1–31, 1988.

[3] U. Akinc and M. B. Khumawala. An efficient branch and bound algorithm for the capacitated warehouse location problem. *Management Science*, 23(6):585–594, 1977.

[4] O. Alp, E. Erkut, and Z. Drezner. An efficient genetic algorithm for the p-median problem. *Annals of Operations Research*, 122:21–42, 2003.

[5] A. Ardalan. A comparison of heuristic methods for service facility locations. *International Journal of Operations and Production Management*, 8(2):52–58, 1988.

[6] S. Arora, P. Raghavan, and S. Rao. Approximation schemes for euclidean k-medians and related problems. In *STOC '98: Proceedings of the 30th Annual ACM Symposium on Theory of Computing*, pages 106–113, 1998.

[7] V. Arya, N. Garg, R. Khandekar, V. Pandit, A. Meyerson, and K. Munagala. Local search heuristics for k-median and facility location problems. *SIAM Journal on Computing*, 33(3):544–562, 2004.

[8] J. Ashayeri, R. Heuts, and B. Tammel. A modified simple heuristic for the p-median problem, with facilities design applications. *Robotics and Computer-Integrated Manufacturing*, 21(4):451–464, 2005.

[9] P. Avella and A. Sassano. On the p-median problem polytope. *Mathematical Programming*, 89(3):395–411, 2001.

[10] P. Avella, A. Sassano, and I. Vasil'ev. Computational study of large-scale p-median problems. Technical Report 08-03, Università di Roma "La Sapienza", 2003.

[11] P. Avella, A. Sassano, and I. Vasil'ev. A heuristic for large-scale p-median instances. *Electronic Notes in Discrete Mathematics*, 13:14–17, 2003.

[12] P. Avella and A. Sforza. Logical reduction tests for the p-median problem. *Annals of Operations Research*, 86:105–115, 1999.

[13] K. R. Baker. A heuristic approach to locating a fixed number of facilities. *Logistics and Transportation Review*, 10(3):195–205, 1974.

[14] M. Balinski. Integer programming, methods, uses and computation. *Management Science*, 12(3):253–313, 1965.

[15] J. E. Beasley. A note on solving large p-median problems. *European Journal of Operational Research*, 21(2):270–273, 1985.

[16] J. E. Beasley. Lagrangean heuristics for location problems. *European Journal of Operational Research*, 65(3):383–399, 1993.

[17] C. Beltran, C. Tadonki, and J.-Ph. Vial. Solving the p-median problem with a semi-lagrangian relaxation. Technical report, Logilab, HEC, University of Geneva, 2004.

[18] O. Bilde and J. Krarup. Sharp lower bounds and efficient algorithms for the simple plant location problem. *Annals of Discrete Mathematics*, 1:79–97, 1977.

[19] T. B. Boffey and J. Karkazis. p-medians and multi-medians. *Journal of the Operational Research Society*, 35(1):57–64, 1984.

[20] I. Borgulya. A hybrid evolutionary algorithm for the p-median problem. In *GECCO '05: Proceedings of the 2005 Conference on Genetic and Evolutionary Computation*, pages 649–650, New York, NY, 2005. ACM Press.

[21] R. L. Bowerman, P. H. Calamai, and G. B. Hall. The demand partitioning method for reducing aggregation errors in p-median problems. *Computers and Operations Research*, 26(10-11):1097–1111, 1999.

[22] B. Bozkaya, J. Zhang, and E. Erkut. An efficient genetic algorithm for the p-median problem. In Z. Drezner and H. Hamacher, editors, *Facility Location: Applications and Theory*, pages 179–205. Berlin: Springer, 2002.

[23] M. L. Brandeau and S. S. Chiu. An overview of representative problems in location research. *Management Science*, 35(6):645–674, 1989.

[24] A. Cabot, R. Francis, and M. Stary. A network flow solution to a rectilinear distance facility location problem. *AIIE Transactions*, 2(2):132–141, 1970.

[25] J. F. Campbell. Hub location and the p-hub median problem. *Operations Research*, 44(6):923–935, 1996.

[26] M. E. Captivo. Fast primal and dual heuristics for the p-median location problem. *European Journal of Operational Research*, 52(1):65–74, 1991.

[27] R. Carbone. Public facilities location under stochastic demand. *INFOR*, 12(3):261–270, 1974.

[28] A. Ceselli. Two exact algorithms for the capacitated p-median problem. *4OR: Quarterly Journal of the Belgian, French and Italian Operations Research Society*, 1:319–340, 2003.

[29] A. Ceselli and G. Righini. A branch-and-price algorithm for the capacitated p-median problem. *Networks*, 45(3):125–142, 2005.

[30] M. Charikar, C. Chekuri, A. Goel, and S. Guha. Rounding via trees: deterministic approximation algorithms for group steiner trees and k-median. In *Proceedings of the 30th Annual ACM Symposium on Theory of Computing*, pages 114–123, 1998.

[31] M. Charikar and S. Guha. Improved combinatorial algorithms for the facility location and k-median problems. In *Proceedings of the 40th Annual Symposium on Foundations of Computer Science*, pages 378–388, 1999.

[32] M. Charikar, S. Guha, É. Tardos, and D. B. Shmoys. A constant-factor approximation algorithm for the k-median problem. In *Proceedings of the 31st Annual ACM Symposium on Theory of Computing*, pages 1–10, 1999.

[33] R. Chen. Solution of minisum and minimax location-allocation problems with Euclidean distances. *Naval Research Logistics Quarterly*, 30:449–459, 1983.

[34] J. Cheriyan and R. Ravi. Approximation algorithms for network problems, lecture notes, 1998.

[35] Y. Chiou and L. W. Lan. Genetic clustering algorithms. *European Journal of Operational Research*, 135(2):413–427, 2001.

[36] F. Chiyoshi and R. D. Galvão. A statistical analysis of simulated annealing applied to the p-median problem. *Annals of Operations Research*, 96:61–74, 2000.

[37] N. Christofides. *Graph Theory: An Algorithmic Approach*. Academic Press, New York, 1975.

[38] N. Christofides and J. E. Beasley. A tree search algorithm for the p-median problem. *European Journal of Operational Research*, 10(2):196–204, 1982.

[39] F. A. Chudak. Improved approximation algorithms for uncapacitated facility location problems. In *IPCO '98: Proceedings of the 6th Conference on Integer Programming and Combinatorial Optimization*, pages 180–194, 1998.

[40] F. A. Chudak and D. P. Williamson. Improved approximation algorithms for capacitated facility location problems. In *IPCO '99: Proceedings of the 7th Conference on Integer Programming and Combinatorial Optimization*, pages 99–113, 1999.

[41] R. L. Church. COBRA: A new formulation of the classic p-median location problem. *Annals of Operations Research*, 122:103–120, 2003.

[42] L. Cooper. Location-allocation problems. *Operations Research*, 11(2):331–343, 1963.

[43] L. Cooper. Heuristic models for location-allocation problems. *SIAM Review*, 6(1):37–53, 1964.

[44] G. Cornuéjols, M. L. Fisher, and G. L. Nemhauser. Location of bank accounts to optimize float: an analytical study of exact and approximate algorithms. *Management Science*, 23:789–810, 1977.

[45] E. S. Correa, M. T. A. Steiner, A. A. Freitas, and C. Carnieri. A genetic algorithm for solving a capacitated p-median problem. *Numerical Algorithms*, 35:373–388, 2004.

[46] T. G. Crainic, M. Gendreau, P. Hansen, and N. Mladenović. Parallel variable neighborhood search for the p-median. *Les Cahiers du GERAD*, G-2003-4, 2003.

[47] T. G. Crainic, M. Gendreau, P. Hansen, and N. Mladenović. Cooperative parallel variable neighborhood search for the p-median. *Journal of Heuristics*, 10(3):293–314, 2004.

[48] J. R. Current and D. A. Schilling. Elimination of source A and B errors in p-median location problems. *Geographical Analysis*, 19:95–110, 1987.

[49] Z. Dai and T. Cheung. A new heuristic approach for the p-median problem. *Journal of the Operational Research Society*, 48(9):950–960, 1997.

[50] M. S. Daskin. *Network and Discrete Location: models, algorithms, and applications*. John Wiley & Sons, Inc., New York, 1995.

[51] P. Davis and T. Ray. A branch-bound algorithm for the capacitated facilities location problem. *Naval Research Logistics Quarterly*, 16:331–344, 1969.

[52] I. R. de Farias, Jr. A family of facets for the uncapacitated p-median polytope. *Operations Research Letters*, 28(4):161–167, 2001.

[53] P. J. Densham and G. Rushton. Designing and implementing strategies for solving large location-allocation problems with heuristic methods. Technical Report 91-10, National Center for Geographic Information and Analysis, Buffalo, NY, 1991.

[54] P. J. Densham and G. Rushton. A more efficient heuristic for solving large p-median problems. *Papers in Regional Science*, 71(3):307–329, 1992.

[55] P. J. Densham and G. Rushton. Strategies for solving large location-allocation problems by heuristic methods. *Environment and Planning A*, 24:289–304, 1992.

[56] G. Diehr. An algorithm for the p-median problem. Technical Report 191, Western Management Science Institute, UCLA, 1972.

[57] Z. Drezner, editor. *Facility Location. A Survey of Applications and Methods.* Springer-Verlag, New York, 1995.

[58] O. du Merle and J.-Ph. Vial. Proximal ACCPM, a cutting plane method for column generation and Lagrangian relaxation: application to the p-median problem. Technical Report 2002.23, HEC Genève, Université de Genève, 2002.

[59] J. Dvorett. Compatibility-based genetic algorithm: A new approach to the p-median problem. Technical report, Department of Industrial Engineering and Management Sciences, Northwestern University, Evanston, IL, 1999.

[60] M. Efroymson and T. Ray. A branch-bound algorithm for plant location. *Operations Research*, 14(3):361–368, 1966.

[61] S. Eilon and R. D. Galvão. Single and double vertex substitution in heuristic procedures for the p-median problem. *Management Science*, 24(16):1763–1766, 1978.

[62] A. M. El-Shaieb. A new algorithm for locating sources among destinations. *Management Science*, 20(2):221–231, 1973.

[63] E. Erkut and B. Bozkaya. Analysis of aggregation errors for the p-median problem. *Computers and Operations Research*, 26(10-11):1075–1096, 1999.

[64] D. Erlenkotter. Facility location with price-sensitive demands: private, public, and quasi-public. *Management Science*, 24(4):378–386, 1977.

[65] D. Erlenkotter. A dual-based procedure for uncapacitated facility location. *Operations Research*, 26(6):992–1009, 1978.

[66] V. Estivill-Castro and R. Torres-Velázquez. Hybrid genetic algorithm for solving the p-median problem. In *SEAL '98: Selected Papers from the Second Asia-Pacific Conference on Simulated Evolution and Learning*, volume 1585 of *Lecture Notes in Computer Science*, pages 19–25, 1999.

[67] M. L. Fisher and D. S. Hochbaum. Probabilistic analysis of the planar k-median problem. *Mathematics of Operations Research*, 5(1):27–34, 1980.

[68] P. M. França, N. M. Sosa, and V. Pureza. An adaptive tabu search algorithm for the capacitated clustering problem. *International Transactions in Operations Research*, 6(6):665–678, 1999.

[69] R. L. Francis and J. M. Goldstein. Location theory: A selective bibliography. *Operations Research*, 22(2):400–410, 1974.

[70] R. L. Francis, T. J. Lowe, and M. B. Rayco. Row-column aggregation for rectilinear distance p-median problems. *Transportation Science*, 30(2):160–174, 1996.

[71] H. Frank. Optimum locations on a graph with probabilistic demands. *Operations Research*, 14(3):409–421, 1966.

[72] R. D. Galvão. A dual-bounded algorithm for the p-median problem. *Operations Research*, 28(5):1112–1121, 1980.

[73] R. D. Galvão. A graph theoretical bound for the p-median problem. *European Journal of Operational Research*, 6(2):162–165, 1981.

[74] R. D. Galvão. A note on Garfinkel, Neebe and Rao's LP decomposition for the p-median problem. *Transportation Science*, 15(3):175–182, 1981.

[75] R. D. Galvão. Rejoinder to "A note on Galvão's a graph theoretical bound for the p-median problem". *European Journal of Operational Research*, 17(1):128, 1984.

[76] R. D. Galvão and L. A. Raggi. A method for solving to optimality uncapacitated location problems. *Annals of Operations Research*, 18:225–244, 1989.

[77] F. García-López, B. Melián-Batista, J. A. Moreno-Pérez, and J. M. Moreno-Vega. The parallel variable neighborhood search for the p-median problem. *Journal of Heuristics*, 8(3):375–388, 2002.

[78] F. García-López, B. Melián-Batista, J. A. Moreno-Pérez, and J. M. Moreno-Vega. Parallelization of the scatter search for the p-median problem. *Parallel Computing*, 29(5):575–589, 2003.

[79] M. R. Garey and D. S. Johnson. *Computers and Intractibility: A guide to the theory of NP-completeness*. W. H. Freeman and Co., San Francisco, 1979.

[80] R. S. Garfinkel, A. W. Neebe, and M. R. Rao. An algorithm for the m-median plant location problem. *Transportation Science*, 8:217–236, 1974.

[81] F. Glover. Tabu search - part I. *ORSA Journal on Computing*, 1(3):190–206, 1989.

[82] F. Glover. Tabu search - part II. *ORSA Journal on Computing*, 2(1):4–32, 1990.

[83] F. Glover. Tabu search for the p-median problem, unpublished manuscript, 1990.

[84] F. Glover and M. Laguna. Tabu search. In C. Reeves, editor, *Modern Heuristic Techniques for Combinatorial Problems*, pages 70–150. Blackwell Scientific Publications, Oxford, 1993.

[85] F. Glover and M. Laguna. *Tabu Search*. Kluwer Academic Publishers, Norwell, MA, 1997.

[86] M. Goemans, A. Goldberg, S. Plotkin, D. Shmoys, É Tardos, and D. Williamson. Improved approximation algorithms for network design problems. In *Proceedings of the 5th Annual ACM-SIAM Symposium on Discrete Algorithms*, pages 223–232, 1994.

[87] A. J. Goldman. Optimal locations for centers in a network. *Transportation Science*, 3:352–360, 1969.

[88] M. F. Goodchild and V. Noronha. Location-allocation for small computers, Monograph No. 8. Technical report, University of Iowa, 1983.

[89] S. Guha and S. Khuller. Greedy strikes back: Improved facility location algorithms. In *Proceedings of the 9th Annual ACM-SIAM Symposium on Discrete Algorithms*, pages 649–657, 1998.

[90] S. L. Hakimi. Optimum locations of switching centers and the absolute centers and medians of a graph. *Operations Research*, 12(3):450–459, 1964.

[91] S. L. Hakimi. Optimum distribution of switching centers in a communication network and some related graph theoretic problems. *Operations Research*, 13(3):462–475, 1965.

[92] G. Y. Handler and P. B. Mirchandani. *Location on Networks: Theory and Algorithms*. MIT Press, Cambridge, MA, 1979.

[93] P. Hanjoul and D. Peeters. A comparison of two dual-based procedures for solving the p-median problem. *European Journal of Operational Research*, 20(3):387–396, 1985.

[94] P. Hansen and N. Mladenović. Variable neighborhood search for the p-median. *Location Science*, 5(4):207–226, 1997.

[95] P. Hansen and N. Mladenović. Variable neighborhood search. In F. Glover and G. Kochenberger, editors, *Handbook of Metaheuristics*, pages 145–184. Kluwer Academic Publisher, 2003.

[96] P. Hansen, N. Mladenović, and D. Perez-Brito. Variable neighborhood decomposition search. *Journal of Heuristics*, 7(4):335–350, 2001.

[97] P. Hansen, N. Mladenović, and É. Taillard. Heuristic solution of the multisource Weber problem as a p-median problem. *Operations Research Letters*, 22(2-3):55–62, 1998.

[98] K. Hidaka and H. Okano. Simulation-based approach to the warehouse location problem for a large-scale real instance. In *WSC '97: Proceedings of the 1997 Winter Simulation Conference*, pages 1214–1221, New York, NY, 1997. ACM Press.

[99] E. L. Hillsman. The p-median structure as a unified linear model for location-allocation analysis. *Environment and Planning A*, 16(3):305–318, 1984.

[100] D. S. Hochbaum. Heuristics for the fixed cost median problem. *Mathematical Programming*, 22(2):148–162, 1982.

[101] M. J. Hodgson. Data surrogation error in p-median models. *Annals of Operations Research*, 110(1-4):153–165, 2002.

[102] M. J. Hodgson and J. Hewko. Aggregation and surrogation error in the p-median model. *Annals of Operations Research*, 123(1-4):53–66, 2003.

[103] C. J. Hoelting, D. A. Schoenefeld, and R. L. Wainwright. Approximation techniques for variations of the p-median problem. In *SAC '95: Proceedings of the 1995 ACM Symposium on Applied Computing*, pages 293–299, New York, NY, 1995. ACM Press.

[104] M. Horn. Analysis and computational schemes for p-median heuristics. *Environment and Planning A*, 28:1699–1708, 1996.

[105] C. M. Hosage and M. F. Goodchild. Discrete space location-allocation solutions from genetic algorithms. *Annals of Operations Research*, 6:35–46, 1986.

[106] M. Hribar and M. S. Daskin. A dynamic programming heuristic for the p-median problem. *European Journal of Operational Research*, 101(3):499–508, 1997.

[107] M. S. Hung and J. R. Brown. A p-median algorithm. In *Proceedings of the Joint ORSA-TIMS Meeting, San Juan, Puerto Rico*, 1974.

[108] K. Jain, M. Mahdian, and A. Saberi. A new greedy approach for facility location problems. In *STOC '02 May 19-21, 2002, Montreal, Quebec, Canada*, 2002.

[109] K. Jain and V. Vazirani. Approximation algorithms for metric facility location and k-median problems using the primal-dual schema and Lagrangian relaxation. *Journal of the ACM*, 48(2):274–296, 2001.

[110] K. Jain and V. V. Vazirani. Primal-dual approximation algorithms for metric facility location and k-median problems. In *Proceedings of the 40th Annual IEEE Symposium on Foundations of Computer Science*, pages 1–10, 1999.

[111] P. Järvinen, J. Rajala, and H. Sinervo. A branch-and-bound algorithm for seeking the p-median. *Operations Research*, 20(1):173–178, 1972.

[112] O. Kariv and S. L. Hakimi. An algorithmic approach to network location problems. II. The p-medians. *SIAM Journal on Applied Mathematics*, 37(3):539–560, 1979.

[113] L. Kaufman, M. V. Eede, and P. Hansen. A plant and warehouse location problem. *Operational Research Quarterly*, 28(3):547–554, 1977.

[114] B. M. Khumawala. Branch-and-bound algorithm for seeking the p-median. Technical report, Krannert Paper Series, Purdue University, Lafayette, Indiana, 1972.

[115] B. M. Khumawala. An efficient algorithm for the p-median problem with maximum distance constraints. *Geographical Analysis*, 5(4):309–321, 1973.

[116] B. M. Khumawala. An efficient heuristic procedure for the uncapacitated warehouse location problem. *Naval Research Logistics Quarterly*, 20:109–121, 1973.

[117] B. M. Khumawala, A. W. Neebe, and D. G. Dannenbring. A note on El-Shaieb's new algorithm for locating sources among destinations. *Management Science*, 21(2):230–233, 1974.

[118] M. B. Khumawala. An efficient branch-and-bound algorithm for the warehouse location problem. *Management Science*, 18(12):718–731, 1972.

[119] T. D. Klastorin. The p-median problem for cluster analysis: A comparative test using the mixture model approach. *Management Science*, 31(1):84–95, 1985.

[120] A. Klose. A branch and bound algorithm for an uncapacitated facility location problem with a side constraint. *International Transactions in Operational Research*, 5(2):155–168, 1998.

[121] M. R. Korupolu, C. G. Plaxton, and R. Rajaraman. Analysis of a local search heuristic for facility location problems. In *Proceedings of the 9th Annual ACM-SIAM Symposium on Discrete Algorithms*, pages 1–10, 1998.

[122] M. R. Korupolu, C. G. Plaxton, and R. Rajaraman. Analysis of a local search heuristic for facility location problems. *Journal of Algorithms*, 37(1):146–188, 2000.

[123] A. A. Kuehn and M. J. Hamburger. A heuristic program for locating warehouses. *Management Science*, 9(4):643–666, 1963.

[124] M. Labbé and F. V. Louveaux. Location problem. In N. DellAmico, F. Maffioli, and S. Martello, editors, *Annotated Bibliographies in Combinatorial Optimization*, pages 264–271. John Wiley and Sons, New York, 1997.

[125] T. V. Levanova. Dual greedy algorithm for the problem of p-median and its generalizations. Technical Report 98-4, Omsk State University, 1998.

[126] T. V. Levanova and M. A. Loresh. Algorithms of ant system and simulated annealing for the p-median problem. *Automation and Remote Control*, 65(3):431–438, 2004.

[127] A. Lim and Z. Xu. A fixed-length subset genetic algorithm for the p-median problem. *Lecture Notes In Computer Science*, 2724:1596–1597, 2003.

[128] J.-H. Lin and J. S. Vitter. Approximation algorithms for geometric median problems. *Information Processing Letters*, 44:245–249, 1992.

[129] L. A. N. Lorena and J. C. Furtado. Constructive genetic algorithm for clustering problems. *Evolutionary Computation*, 9(3):309–328, 2001.

[130] L. A. N. Lorena and E. L. F. Senne. Local search heuristics for capacitated p-median problems. *Networks and Spatial Economics*, 3:409–419, 2003.

[131] L. A. N. Lorena and E. L. F. Senne. A column generation approach to capacitated p-median problems. *Computers and Operations Research*, 31(6):863–876, 2004.

[132] R. F. Love, J. G. Morris, and G. O. Wesolowsky. *Facilities Location: Models & Methods*. North Holland, 1989.

[133] M. Mahdian, E. Markakis, A. Saberi, and V. Vazirani. A greedy facility location algorithm analyzed using dual fitting. In *APPROX 2001: Proceedings of the International Workshop on Approximation Algorithms for Combinatorial Optimization Problems*, pages 127–137, 2001.

[134] V. Maniezzo, A. Mingozzi, and R. Baldacci. A bionomic approach to the capacitated p-median problem. *Journal of Heuristics*, 4:263–280, 1998.

[135] F. E. Maranzana. On the location of supply points to minimize transport costs. *Operations Research Quarterly*, 15(3):261–270, 1964.

[136] R. E. Marsten. An algorithm for finding almost all the medians of a network. Technical Report 23, Center for Math Studies in Economics and Management Science, Northwestern University, 1972.

[137] D. W. Matula and R. Kolde. Efficient multi-median location in acyclic networks. In *Proceedings of the ORSA-TIMS meeting, Miami, FL*, 1976.

[138] L. Mavrides. An indirect method for the generalized k-median problem applied to lock-box location. *Management Science*, 25(10):990–996, 1979.

[139] E. D. Merino and J. M. Pérez. An efficient neural network algorithm for the p-median problem. In *IBERAMIA 2002: Proceedings of the 8th Ibero-American Conference on AI*, volume 2527 of *Lecture Notes in Computer Science*, pages 460–469, 2002.

[140] E. D. Merino, J. M. Pérez, and J. J. Aragonés. Neural network algorithms for the p-median problem. In *ESANN 2003: Proceedings of 11th European Symposium on Artificial Neural Networks, Belgium, April 2003*, pages 385–391, 2003.

[141] R. Mettu. *Approximation Algorithms for NP-Hard Clustering Problems*. PhD thesis, Department of Computer Science, University of Texas at Austin, 2002.

[142] P. Mirchandani. Medians on networks. Technical report, Rensselaer Polytechnic Institute, Troy, NY, 1977.

[143] P. B. Mirchandani and R. Francis, editors. *Discrete location theory*. Wiley-Interscience Series in Discrete Mathematics and Optimization. John Wiley & Sons, Inc., New York, 1990.

[144] P. B. Mirchandani, A. Oudjit, and R. T. Wong. 'Multidimensional' extensions and a nested dual approach for the m-median problem. *European Journal of Operational Research*, 21(1):121–137, 1985.

[145] J. A. Moreno-Pérez, J. M. Moreno-Vega, and N. Mladenović. Tabu search and simulated annealing in the p-median problem. In *Proceedings of the Canadian Operational Research Society Conference, Montreal*, 1994.

[146] J. A. Moreno-Pérez, J. L. Roda García, and J. M. Moreno-Vega. A parallel genetic algorithm for the discrete p-median problem. *Studies in Locational Analysis*, 7:131–141, 1994.

[147] L. Morgenstern. A note on Galvão's "A graph theoretical bound for the p-median problem". *European Journal of Operational Research*, 12(4):404–405, 1983.

[148] J. G. Morris. On the extent to which certain fixed charges depot location problems can be solved by LP. *Journal of the Operational Research Society*, 29(1):71–76, 1978.

[149] A. T. Murray and J. M. Gottsegen. The influence of data aggregation on the stability of p-median location model solutions. *Geographical Analysis*, 29(3):200–213, 1997.

[150] S. C. Narula, U. I. Ogbu, and H. M. Samuelsson. An algorithm for the p-median problem. *Operations Research*, 16(5):955–961, 1968.

[151] A. W. Neebe. A branch and bound algorithm for the p-median transportation problem. *Journal of the Operational Research Society*, 29(10):989–995, 1978.

[152] A. W. Neebe and M. R. Rao. A subgradient approach to the m-median problem. Technical Report 75-12, University of North Carolina, Chapel Hill, N.C., 1975.

[153] G. L. Nemhauser and L. A. Wolsey. *Integer and Combinatorial Optimization*. John Wiley and Sons, Inc., New York, 1990.

[154] I. Osman and N. Christofides. Capacitated clustering problems by hybrid simulated annealing and tabu search. *International Transactions in Operational Research*, 1(3):317–336, 1994.

[155] D. Peeters and I. Thomas. The effect of spatial structure on p-median results. *Transportation Science*, 29(4):366–373, 1995.

[156] H. Pirkul, R. Gupta, and E. Rolland. VisOpt: a visual interactive optimization tool for p-median problems. *Decision Support Systems*, 26(3):209–223, 1999.

[157] N. D. Pizzolato. A heuristic for large-size p-median location problems with application to school location. *Annals of Operations Research*, 50:473–485, 1994.

[158] F. Plastria. On the choice of aggregation points for continuous p-median problems: a case for the gravity centre. *Top*, 9(2):217–242, 2001.

[159] C. G. Plaxton. Approximation algorithms for hierarchical location problems. In *Proceedings of the 35th Annual ACM Symposium on Theory of Computing*, pages 40–49, 2003.

[160] S. Rahman and D. K. Smith. A comparison of two heuristic methods for the p-median problem with and without maximum distance constraints. *International Journal of Operations and Production Management*, 11(6):76–84, 1991.

[161] M. G. C. Resende and R. F. Werneck. A GRASP with path-relinking for the p-median problem. Technical Report TD-5E53XL, AT & T Labs Research, 2002.

[162] M. G. C. Resende and R. F. Werneck. On the implementation of a swap-based local search procedure for the p-median problem. In R. Ladner, editor, *ALENEX '03: Proceedings of the Fifth Workshop on Algorithm Engineering and Experiments*, pages 119–127, Philadelphia, 2003. SIAM.

[163] M. G. C. Resende and R. F. Werneck. A fast swap-based local search procedure for location problems. Technical Report TD-5R3KBH, AT & T Labs Research, 2004.

[164] M. G. C. Resende and R. F. Werneck. A hybrid heuristic for the p-median problem. *Journal of Heuristics*, 10(1):59–88, 2004.

[165] M. G. C. Resende and R. F. Werneck. A hybrid multistart heuristic for the uncapacitated facility location problem. *European Journal of Operational Research*, 2005. To appear.

[166] C. ReVelle, D. Marks, and J. Liebman. An analysis of private and public sector location models. *Management Science*, 16(11):692–707, 1970.

[167] C. ReVelle and R. Swain. Central facilities location. *Geographical Analysis*, 2:30–42, 1970.

[168] G. Righini. A double annealing algorithm for discrete location/allocation problems. *European Journal of Operational Research*, 86(3):452–468, 1995.

[169] E. Rolland, D. A. Schilling, and J. R. Current. An efficient tabu search procedure for the p-median problem. *European Journal of Operational Research*, 96(2):329–342, 1996.

[170] K. E. Rosing. An empirical investigation of the effectiveness of a vertex substitution heuristic. *Environment and Planning B*, 24:59–67, 1997.

[171] K. E. Rosing, E. L. Hillsman, and H. Rosing-Vogelaar. A note comparing optimal and heuristic solutions to the p-median problem. *Geographical Analysis*, 11(1):86–89, 1979.

[172] K. E. Rosing, E. L. Hillsman, and H. Rosing-Vogelaar. The robustness of two common heuristics for the p-median problem. *Environment and Planning A*, 11:373–380, 1979.

[173] K. E. Rosing and M. J. Hodgson. Heuristic concentration for the p-median: An example demonstrating how and why it works. *Computers and Operations Research*, 29(10):1317–1330, 2002.

[174] K. E. Rosing and C. S. ReVelle. Heuristic concentration: Two stage solution construction. *European Journal of Operational Research*, 97(1):75–86, 1997.

[175] K. E. Rosing, C. S. ReVelle, E. Rolland, D. A. Schilling, and J. R. Current. Heuristic concentration and tabu search: A head to head comparison. *European Journal of Operational Research*, 104(1):93–99, 1998.

[176] K. E. Rosing, C. S. ReVelle, and H. Rosing-Vogelaar. The p-median and its linear programming relaxation: An approach to large problems. *Journal of the Operational Research Society*, 30(9):815–823, 1979.

[177] K. E. Rosing, C. S. ReVelle, and D. A. Schilling. A gamma heuristic for the p-median problem. *European Journal of Operational Research*, 117(3):522–532, 1999.

[178] R. E. Rosing and C. S. ReVelle. A method for optimal solutions to large p-median problems. Technical report, Economic Geography Institute, Erasmus University, Rotterdam, 1978.

[179] G. T. Ross and R. M. Soland. Modeling facility location problems as generalized assignment problems. *Management Science*, 24(3):345–357, 1977.

[180] G. Rushton and J. A. Kohler. ALLOC: Heuristic solutions to multi-facility location problems on a graph. In G. Rushton, M. Goodchild, and L. Ostresh, editors, *Computer Programs for Location-Allocation Problems*, pages 163–187. Monograph No. 6, Department of Geography, University of Iowa, Iowa City, 1973.

[181] G. Sá. Branch-and-bound and approximate solutions to the capacitated plant-location problem. *Operations Research*, 17(6):1005–1016, 1969.

[182] S. Salhi. A perturbation heuristic for a class of location problems. *Journal of the Operational Research Society*, 48(12):1233–1240, 1997.

[183] S. Salhi. Defining tabu list size and aspiration criterion within tabu search methods. *Computers and Operations Research*, 29(1):67–86, 2002.

[184] D. A. Schilling, K. E. Rosing, and C. S. ReVelle. Network distance characteristics that affect computational effort in p-median location problems. *European Journal of Operational Research*, 127(3):525–536, 2000.

[185] E. L. F. Senne and L. A. N. Lorena. Lagrangean/surrogate heuristics for p-median problems. In M. Laguna and J. Gonzalez-Velarde, editors, *Computing Tools for Modeling, Optimization and Simulation: Interfaces in Computer Science and Operations Research*, pages 115–130. Kluwer Academic Publishers, 2000.

[186] E. L. F. Senne and L. A. N. Lorena. Stabilizing column generation using Lagrangean/surrogate relaxation: an application to p-median location problems. In *Proceedings of the EURO2001 Conference, Erasmus University, Rotterdam, July 2001*, 2001.

[187] E. L. F. Senne and L. A. N. Lorena. Complementary approaches for a clustering problem. In *XI CLAIO: Latin-Iberian American Congress of Operations Research, Concepcin, Chile, October 2002*, 2002.

[188] E. L. F. Senne, L. A. N. Lorena, and M. A. Pereira. A branch-and-price approach to p-median location problems. *Computers and Operations Research*, 32(6):1655–1664, 2005.

[189] D. B. Shmoys, É. Tardos, and K. I. Aardal. Approximation algorithms for facility location problems. In *Proceedings of the 29th Annual ACM Symposium on Theory of Computing*, pages 265–274, 1997.

[190] S. Singer. Multi-centers and multi-medians of a graph with and application to optimal warehouse location. *Proceedings of the 16th TIMS conference*, 1968.

[191] K. Spielberg. Algorithms for the simple plant-location problem with some side constraints. *Operations Research*, 17(1):85–111, 1969.

[192] R. Swain. A parametric decomposition algorithm for the solution of uncapacitated location problems. *Management Science*, 21(2):189–198, 1974.

[193] É. D. Taillard. Heuristic methods for large centroid clustering problems. Technical Report 96-96, Istituto Dalle Molle Di Studi Sull Intelligenza Artificiale, 1996.

[194] A. Tamir. An $O(pn^2)$ algorithm for the p-median and related problems on tree graphs. *Operations Research Letters*, 19(2):59–64, 1996.

[195] B. C. Tansel, R. L. Francis, and T. J. Lowe. Location on networks: a survey. I. The p-center and p-median problems. *Management Science*, 29(4):482–497, 1983.

[196] M. B. Teitz and P. Bart. Heuristic methods for estimating the generalized vertex median of a weighted graph. *Operations Research*, 16(5):955–961, 1968.

[197] M. Thorup. Quick k-median, k-center, and facility location for sparse graphs. In *ICALP '01: Proceedings of the 28th International Colloquium on Automata, Languages and Programming*, volume 2076 of *Lecture Notes in Computer Science*, pages 249–260, 2001.

[198] C. Toregas, R. Swain, C. ReVelle, and L. Bergman. The location of emergency service facilities. *Operations Research*, 19(6):1363–1373, 1971.

[199] S. Viswanathan. A new approach for solving the p-median problem in group technology. *International Journal of Production Research*, 34(10):2691–2700, 1996.

[200] S. Voß. A reverse elimination approach for the p-median problem. *Studies in Locational Analysis*, 8:49–58, 1996.

[201] J. E. Ward, R. T. Wong, P. Lemke, and A. Oudjit. Properties of the k-median linear programming relaxation. Technical report, Rensselaer Polytechnic Institute, 1998.

[202] J. R. Weaver and R. L. Church. Computational procedures of location problems on stochastic networks. *Transportation Science*, 17(2):168–180, 1983.

[203] R. E. Wendell and A. P. Hunter. Optimal locations on a network. *Transportation Science*, 7:18–33, 1973.

[204] R. A. Whitaker. A tight bound drop exchange algorithm for solving the p-median problem. *Environment and Planning A*, 13:669–680, 1981.

[205] R. A. Whitaker. Some interchange algorithms for median location problems. *Environment and Planning B*, 9:119–129, 1982.

[206] R. A. Whitaker. A fast algorithm for the greedy interchange of large-scale clustering and median location problems. *INFOR*, 21(2):95–108, 1983.

[207] N. E. Young. Greedy approximation algorithms for k-medians by randomized rounding. Technical Report PCS-TR99-344, Department of Computer Science, Dartmouth College, Hanover, NH, 1999.

[208] N. E. Young. K-medians, facility location, and the Chernoff-Wald bound. In *ACM-SIAM Symposium on Discrete Algorithms*, pages 86–95, 2000.

[209] P. Zhao and R. Batta. Analysis of centroid aggregation for the Euclidean distance p-median problem. *European Journal of Operational Research*, 113(1):147–168, 1999.