Routing and scheduling problems

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In today's globalized society, transport contributes to our daily life in many different ways. The production of the parts for a shelf ready product may take place on several continents and our travel between home and work, vacation travel and business trips has increased in distance the last couple of decades. To deliver competitive service and price, transportation today needs to be cost effective. A company requiring for things to be shipped will aim at having the freight shipped as cheaply as possible while often satisfying certain time constraints. For the transportation company, the effectiveness of the network is of importance aiming at satisfying as many customer demands as possible at a low cost. Routing represent a path between locations such as an origin and destination for the object routed. Sometimes routing has a time dimension as well as the physical paths. This may be that the objects routed have an availability time window and a delivery time window or that locations on the path have a service time window. When routing moving transportation objects such as vehicles and vessels schedules are made in connection with the routing. Such schedules represent the time for the presence of a connection between two locations. This could be an urban bus schedule where busses are routed and this routing creates a bus schedule which the passengers between locations use. In this thesis various routing and scheduling problems will be presented. The topics covered will be routing from an origin to a destination on a predefined network, the routing and scheduling of vessels in a liner shipping network given a demand forecast to be covered, the routing of manpower and vehicles transporting disabled passengers in an airport and the vehicle routing with time windows where one version studied includes edge set cost making the cost of the individual vehicle routes interdependent. Depending on the problem type, the size of the problems and time available for solving, different solution methods can be applicable. In this thesis both heuristic methods and several exact methods are investigated depending on the problems needed to be solved. The solution methods applied to the problems cover dynamic programming for multi constrained shortest paths, Branch-and-cut for liner shipping, Simulated annealing for transporting assisted passengers in airports, branch-cut-and-price for vehicle routing with time windows and edges set costs.

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