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Travelling Salesman Problem

Major Slides Content: Anany Levitin

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Exhaustive Search

- Exhaustive Search is a brute force problem solving technique
- It suggests generating each and every element of the problem domain, selecting those of them that satisfy all the constraints and then finding a desired element
- The desired element might be one which minimizes or maximizes a certain characteristic
- Typically the problem domain involves combinatorial objects such as permutations, combinations and subsets of a given set



Exhaustive Search - Method

- Generate a list of all potential solutions to the problem in a systematic manner
- Evaluate potential solutions one by one, disqualifying infeasible ones and, for an optimization problem, keeping track of the best one found so far
- When search ends, announce the solution(s) found



Travelling Salesman Problem

• Given a list of cities and the distances between each pair of cities, what is the shortest possible route that visits each city and returns to the origin city?

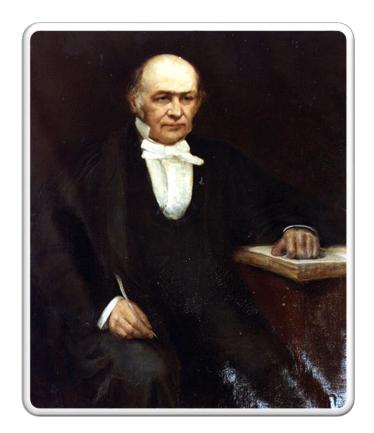


• Find the shortest Hamiltonian Circuit in a weighted connected graph



TSP: History and Relevance

- The Travelling Salesman Problem
 was mathematically formulated by
 Irish Mathematician Sir William
 Rowan Hamilton
- It is one of the most intensively studied problems in optimization
- It has applications in logistics and planning

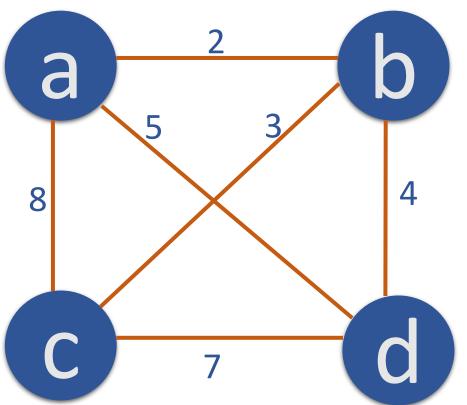




Travelling Salesman Problem



Example



Tour	Length
$a\rightarrow b\rightarrow c\rightarrow d\rightarrow a$	2+3+7+5 = 17
$a\rightarrow b\rightarrow d\rightarrow c\rightarrow a$	2+4+7+8 = 21
$a\rightarrow c\rightarrow b\rightarrow d\rightarrow a$	8+3+4+5 = 20
$a\rightarrow c\rightarrow d\rightarrow b\rightarrow a$	8+7+4+2 = 21
$a\rightarrow d\rightarrow b\rightarrow c\rightarrow a$	5+4+3+8 = 20
$a \rightarrow d \rightarrow c \rightarrow b \rightarrow a$	5+7+3+2 = 17

Travelling Salesman Problem

Efficiency

- The Exhaustive Search solution to the Travelling Salesman problem can be obtained by keeping the origin city constant and generating permutations of all the other n-1 cities
- Thus, the total number of permutations needed will be (n-1)!





THANK YOU

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