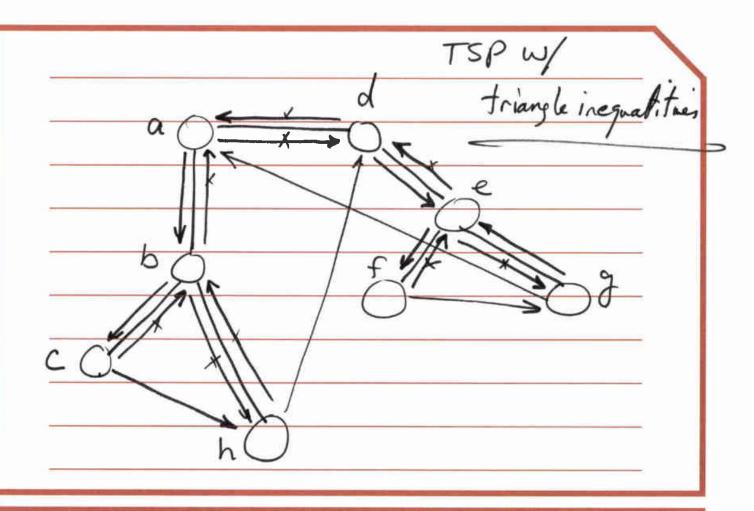# Approximation to TSP

TSP w/
triangle inequalities

Initial tour had a cost of = 2 * Cost of MST

Cost of MST ≤ Cost of opt tour

Cost of my approx. tour ≤ 2 * (Cost of opt tour)

This is a 2-approx. alg.

General TSP

Theorem: if $P \neq NP$, then for any constant $\rho \geq 1$, there is no polyn. time approx. alg. with approx. ratio ρ for the general TSP.

Assume ~~there~~ there is such an approx. alg.. We will then use it to solve the HC problem.

Let $G = (V, E)$ be an instance of the HC problem.

Create $G' = (V, E')$ a complete graph

assign costs $C_{(u,v)} = \begin{cases} 1 & \text{if } (u,v) \in E \\ \rho |V| + 1 & \text{otherwise} \end{cases}$

will show that G has a HC iff G' has a tour of cost $\leq \rho |V|$

if G has a HC, then cost of the opt. tour in G' will be $|V|$

So if the tour contains one edge that is not in G'' $\Rightarrow$ cost of the tour

$$\geq \rho|V| + 1 + |V| - 1$$

$$\geq \rho|V| + |V| > \rho|V|$$