Traveling Salesperson Problem

- TSP. Given a set of n cities and a pairwise distance function d(u, v), is there a tour of length $\leq$ D?
- HAM-CYCLE: given a graph G = (V, E), does there exists a simple cycle that contains every node in V.

- Claim. HAM-CYCLE $\leq_P$ TSP.
- Pf.
  - Given instance G = (V, E) of HAM-CYCLE, create n cities with distance function

$$d(u, v) = \begin{cases} 1 & \text{if } (u, v) \in E \\ 2 & \text{if } (u, v) \notin E \end{cases}$$

  - G is Hamiltonian iff TSP instance has tour of length $\leq$ D=n. (proof is omitted) ■
- Remark. TSP instance in reduction satisfies Δ-inequality.