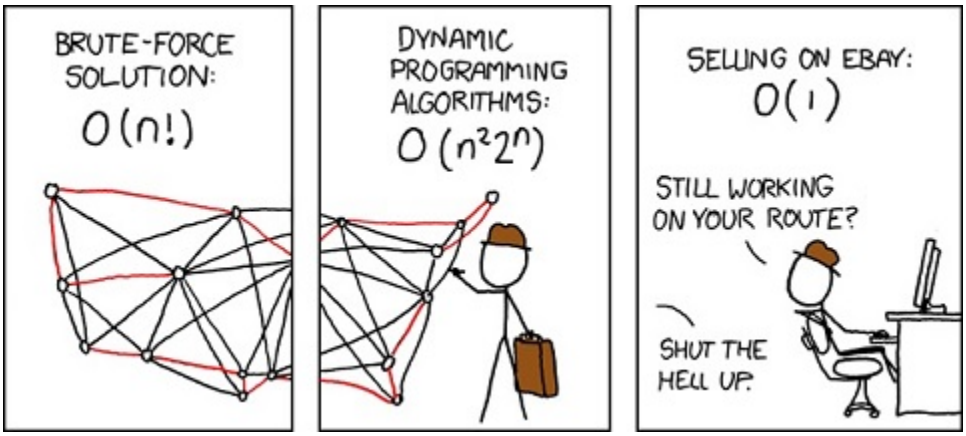
CSCI 270 Lecture 26: Sequencing Problems

Travelling Salesman Problem

Given a set of n cities, a distance function $d(u, v)$ which specifies the distance between any two cities u and v, and a value D, find a tour of length $\leq D$.

From the comic XKCD:



Directed Longest Path

Given a directed graph and an integer k, is there a path of $\geq k$ nodes?

Undirected Longest Path

Given an undirected graph and an integer k, is there a path of $\geq k$ nodes?

What makes a problem NP-complete?

How does one recognize an NP-complete problem? You can't until you give a reduction. It is very difficult to tell at a glance.

Longest path is NP-complete.

Longest path on a DAG is easy!

3-SAT is NP-complete.

2-SAT is easy!

Independent Set is NP-Complete.

Independent Set on a tree is easy!

Subset Sum

Given n positive integers $w_1, w_2, ..., w_n$ and a target W is there a subset of integers which add up exactly to W?

		x_1	x_2	x_3	C_1	C_2	C_3	C_4
v_1	=	1	0	0	1	0	0	1
v_1'	=	1	0	0	0	1	1	0
v_2	=	0	1	0	0	0	0	1
v_2'	=	0	1	0	1	1	1	0
v_3	=	0	0	1	0	0	1	1
v_3'	=	0	0	1	1	1	0	0
s_1	=	0	0	0	1	0	0	0
s_1'	=	0	0	0	2	0	0	0
s_2	=	0	0	0	0	1	0	0
s_2'	=	0	0	0	0	2	0	0
s_3	=	0	0	0	0	0	1	0
s_3'	=	0	0	0	0	0	2	0
s_4	=	0	0	0	0	0	0	1
s_4'	=	0	0	0	0	0	0	2
t	=	1	1	1	4	4	4	4