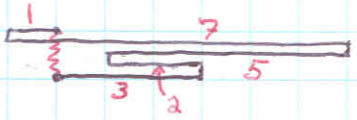
6.885
L15.4
Nov. 3, 2004

Span of configuration of open chain
= distance between two endpoints

Motivation: in polymer physics & other areas, distribution of span over configuration space is heavily studied (≥22 papers)
- in particular, mean squared span
- first step: min span & max span [Soss 2001]

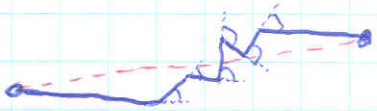
Min (flat) Span is NP-hard [Soss 2001]
- reduction from PARTITION (divide n (integer) numbers into two subsets of equal sum)
- horizontal bars for numbers
- vertical bars in between of length $< 1/n$.



⇒ can flip horizontal bars left or right

- min span < 1 ⇔ PARTITION instance solvable

Max flat span is NP-hard [Soss 2001]



- reduction from PARTITION
- sequence of bars with turn angles = $\frac{\text{numbers}}{\text{sum of all numbers}}$
- end bars very long; other bars short
- span maximized when long bars point straight away (parallel)

  i.e. when $\sum$ turn angles $= 0$
- edge flips choose sign on turn angle

OPEN: min span & max span in 3D?
NP-hard or polynomial time? different, at least.

OPEN: pseudopolynomial-time algorithms?
(when small number of distinct bar lengths, e.g.)