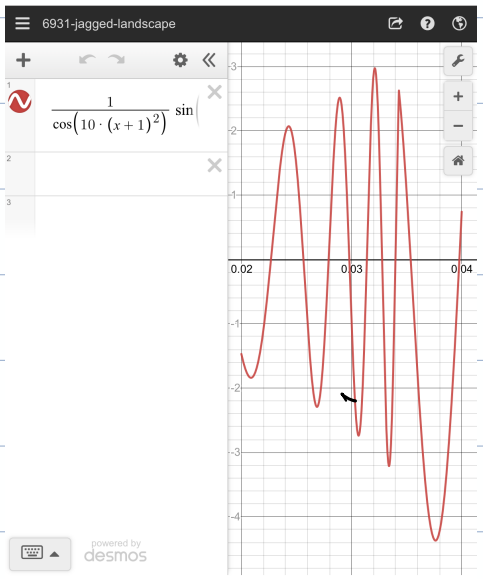
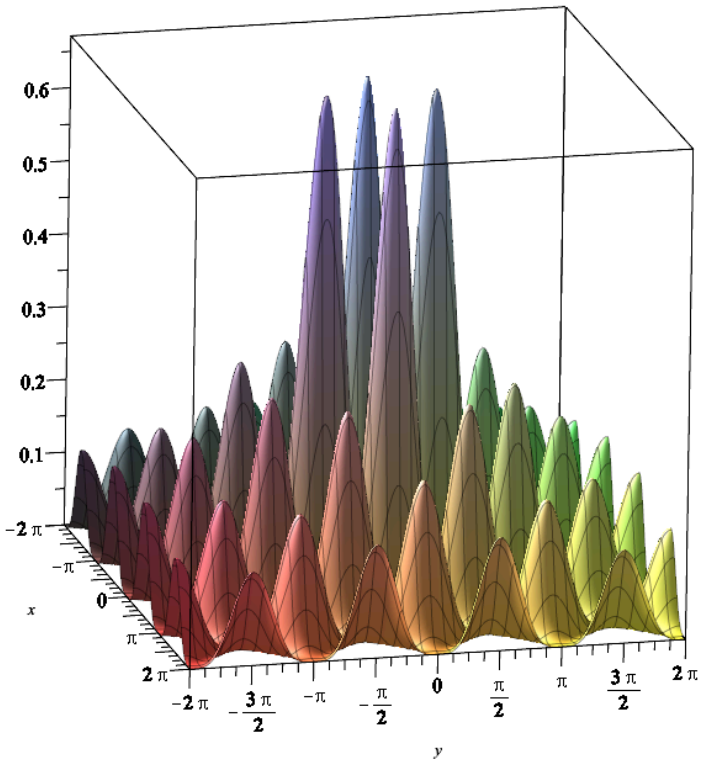

6931-jagged-landscape
$\frac{1}{\cos\left(10 \cdot (x+1)^2\right)} \sin($
0.02
0.03
0.04
powered by desmos


0.6
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-2π
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x
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$-\pi$
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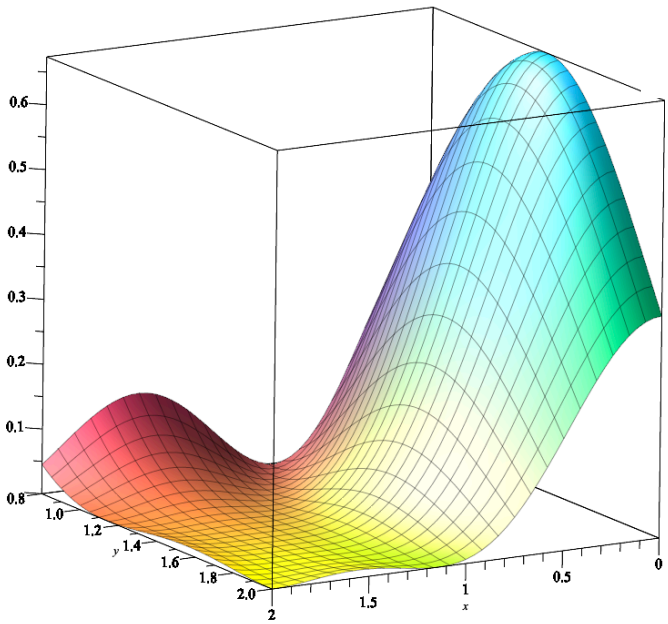
$\frac{\pi}{2}$
π
$\frac{3\pi}{2}$
2π
y


0.6
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Friday, March 19 Lecture #23

Topic 11 - Introduction to Metaheuristics

We've mostly focused on finding optimal solutions.
Problem: these methods are hard and not always applicable

Ex: TSP takes $O(n^2 \cdot 2^n)$ time for dynamic programming.

Metaheuristics:
- General problem solving paradigms that can be easily adapted to many problems.
- Look for good solutions, not optimal ones
- Pretty fast

Similar Setup:
* Search space of candidates / solutions

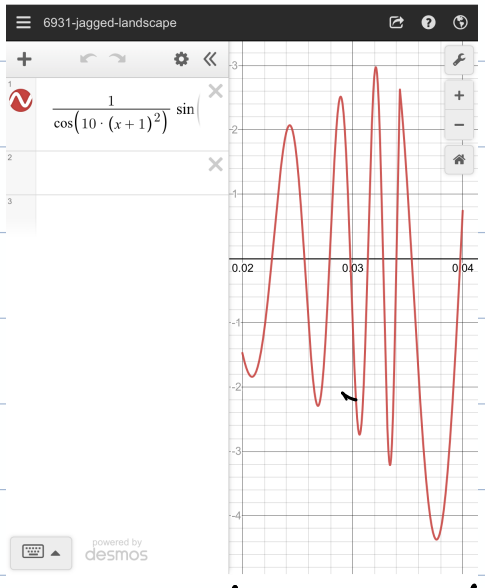
* Every candidate has a score / fitness / quality
* Find a candidate with a good score (max or min)

Many of our problems will be discrete (finite search space), but some will be continuous.

Ex: Find the maximum value of

$$f(x) = \frac{1}{\cos\left(10(x+1)^2\right)} \cdot \sin\left(\min\left((x+1)^{100}, \frac{1}{x}\right)\right)$$

on the interval $0.02 \leq x \leq 0.04$.



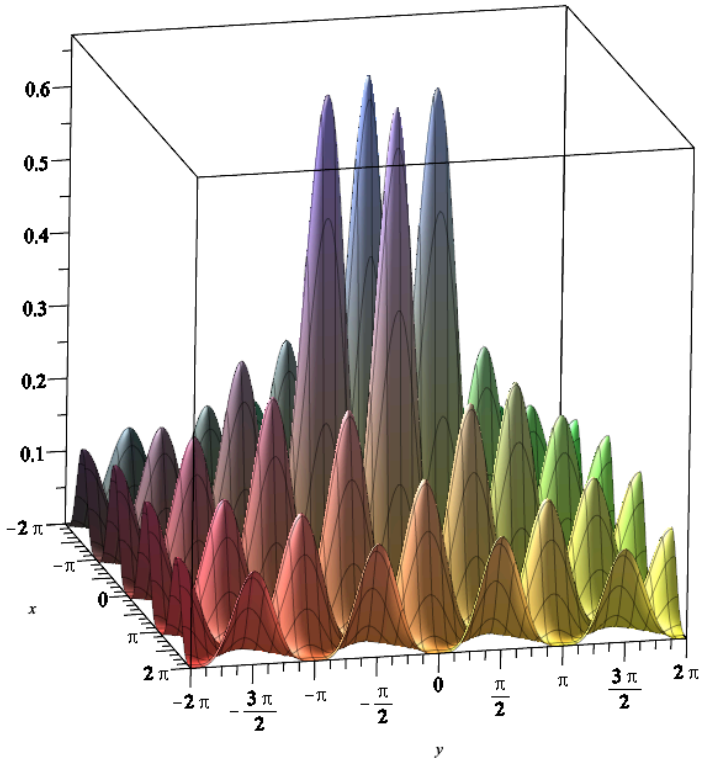
Calculus: maybe

Most of the spaces we'll look at are not 1D.

Ex: TSP $n = 10$ $9!$

"landscape pictures"

$$f(x,y) = \frac{\sin^2(x-y)\sin^2(x+y)}{\sqrt{x^2+y^2}}$$



Goal: find the top of the tallest hill, but not get stuck on the wrong hilltop.

Gradient Ascent ("Descent")

* Optimization method (not a M-H)
* If your function $f(x,y)$ is diff'ble, you can compute the gradient at a point.

Gradient is a vector that points you in the direction of steepest ascent.

(1) Start at a point
(2) compute the gradient
(3) move a little in that direction
(4) repeat