Wed, Apr. 10, 2024

Announcements:

→ HW 5 due Monday, April 22

2 questions using Hill-Climbing

Process:

```
Pick an initial temperature                    (How?)
x = random elt. in search space
best = x
Repeat:                                         (How many times?)
    For a while:                                (How long?)
        s = tweak(x)
        Δ = score(s) - score(x)
        if Δ > 0:
            x = s
            if score(x) > score(best):
                best = x
        else:
            r = random # in [0,1]
            if r < e^(Δ/T):
                x = s
    adjust the temperature according
    to the cooling schedule
```

Questions to answer:

* How to pick an initial temp
* How long to loop for each temp
* When to stop
* How to cool

art, not science

Picking the initial temperature.

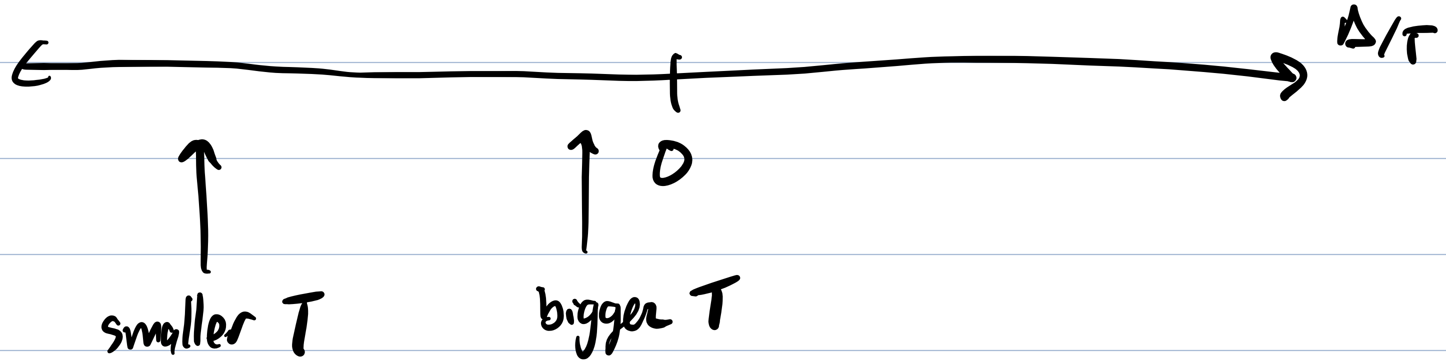
What's the goal?

We want an initial temp, P_0, that leads to us accepting 50% – 100% of worse solutions at the beginning.

One way: Pick a random # in your head. Try it in your code, and see if it works.

$e^{\Delta/T}$ Worse solutions ⇒ $\Delta < 0$

Bigger T means Δ/T is negative but closer to 0.



$e^{\Delta/T}$ is closer to 1 when T is bigger
further from 1 when T is smaller

An initial temperature might be good for some input data and bad for others.

Another way: Want something dynamic that picks for us

Picking what initial probability you want, call it p_0. (Ex: $p_0 = 0.5$ or $p_0 = 0.8$)

$p = 0.8$ is a pretty safe bet for most problems.

Goal: Pick an initial temp T_0 such that

$p = e^{\Delta / T_0}$ is roughly p_0.

0.8

We don't know Δ, it depends on the solution being tweaked, so we can simulate a bunch of tweaks to find an average Δ.

Pseudocode:

```
trials = [ ]
while len(trials) < 1000:
    x = random elt. of search space
    s = tweak(x)
    if score(s) < score(x):
        trials.append(score(s) - score(x))
avg = sum(trials) / 1000
```

$$p = e^{\Delta / T} \Rightarrow \ln(p) = \frac{\Delta}{T} \Rightarrow T = \frac{\Delta}{\ln(p)}$$

$$T_0 = \frac{\text{avg worse } \Delta}{\ln(\text{desired } p_0)}$$