The Previous Analysis was for **Any Iterative Search Method**. We applied the analysis to Random Search and Greedy Search. Now we move to a more detailed analysis of Simulated Annealing (in chapter 2).
• What is the acceptance $A_{ij}(T)$ for simulated Annealing with a fixed parameter $T$?

• What is the value of the matrix $\Theta$?

• What can we say about the convergence of Simulated Annealing?

• Let’s look first at an example from the book.
SIMULATED ANNEALING

Assume we have a scalar optimization problem with only 4 possible values for the decision variable. The cost of the 4 values is given inside the circle. The neighborhood is just adjacent points. What is the configuration graph for a simulated annealing search?

How do we work this out? We assume equal probability of picking any of the neighbors. I.e. $P_{12} = \frac{1}{2}$, $P_{14} = \frac{1}{2}$, $P_{13} = 0$, because 3 isn’t a neighbor.
Simulated Annealing

- There are two steps in SA:
- 1) Pick the neighbor whose cost function you will evaluate = “picking a neighbor”
- 2) Deciding if you will accept the move to that neighbor = “accepting the neighbor”
- Probability of “picking a neighbor” = $p_{kj}$
- Probability of “accepting the neighbor” = $A_{kj}$
So total probability is product of $p$ and $A$

So let $\theta_{ij}$ be the probability of going from $i$ to $j$

$$\theta_{ij}(t) = \begin{cases} A_{ij}(T) \ p_{ij} & \text{if } i \neq j \\ 1 - \sum_{i \neq k} A_{ik}(T) \ p_{ij} & \text{if } i = j \end{cases}$$

$T$ is the iteration varying parameter (e.g. temperature)
What is $A_{kj}$ for SA?

- $(\text{Cost}(j) - \text{Cost}(k)) = (\text{def}) = \Delta \text{Cost}_{kj}$

- So the probability of accepting an uphill move from k to j is

- $= \exp (- \Delta \text{Cost}_{kj})$

- Now when we consider the transition probability $\theta$, there are 4 situations
  - Downhill move
  - Uphill move accepted
  - No move
  - No edge so no possibility to move from k to j