classmate
Date 22/10/24
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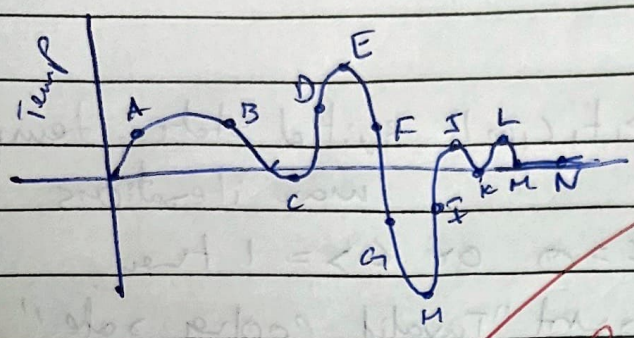
LAB-5 Simulated Annealing

Algorithm

1. Initialize the temperature and a random solution
   -> using a list to represent the solution
2. evaluate the objective function
   -> calculate the value of objective function.
   -> The value is stored to track how good the existing solution is.
3. Generate a new solution in the neighborhood of the current solution.
   -> get a small perturbation of the existing solution.
   -> calculate the objective value for the neighboring solution.
4. Compare the new solution to the current one
   -> if the new solution is better (new < old) accept it
   -> if worse, accept with a certain probability depending on the temperature.
5. Gradually lower the temperature.
   -> Multiply the temperature by a constant cooling rate to gradually reduce it.
6. Repeat until the temperature reaches a low point or if the number of iterations are met.

Example



Lab 8B
22/10/24

Pseudocode

```
Function obj(x)
    return x^2
end Function.
Function sa(s,t,c,m)
    set cs = s          // current state
    set bs = cs         // best state
    set be = obj(cs)    // best energy.
    for i from 1 to m Do
        set ns = cs + Random(-1,1) // new state
        set ne = obj(ns)           // new energy
        set ed = ne - be           // energy difference.
        if ed<0 or random(0,1) < exp(-ed/t) then
            set cs = ns
            set be = ne
            set bs = cs If ne<be
        end If
        set t = t*c          // cool down.
        Print i, cs, be, t
    end for
```

```
    return bs, be
end function
Begin
    read S, t, c, m // initial state, temp, cooling rate
                       max iterations
    If c<=0 or c>=1 then
        Print "Invalid cooling rate."
        Exit
    End If
    bs, be = sa(S, t, c, m)
    Print bs, be
end.
```

Output

Enter the initial state (starting point): 10
Enter the initial temp: 12
Enter the cooling rate (btw 0-1): 0.3
Enter the no. of iterations: 25

Iteration 1: Current state = 10: 0121, current energy = 100.40 Temp = 3.600
" 2: " = 10: 0121, " = " " = 1.0800
" 3: " = 10: 0121, " = " " = 0.3240.

Best State: 6.4816, Best energy: 42.0111

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