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1  /*
2   | Divide & Conquer DP Optimization |
3   Desc: Optimizing DP transitions in the form of
4
5       dp[i][j] = min(dp[i-1][k-1] + C(k,j)) for (0 ≤ k ≤ j)
6
7   where C(k,j) is a cost function.
8
9   lets define opt(i,j) be the value of k that optimize dp[i][j].
10  DnC ONLY APPLIES IF:
11
12       opt(i,j) ≤ opt(i,j+1)
13
14  One case of where this condition holds is when cost function C(k,j) satisfy
the Quadrangle Inequality:
15
16       C(a,c) + C(b,d) < C(a,d) + C(b,c) for a ≤ b ≤ c ≤ d. (Note that "<"
indicates more optimal)
17
18  Runs in O(n*log(n)*C) with C is time to compute Cost function C(k,j)
19
20  Source: KawakiMeido
21  State: Untested lmao
22  */
23
24  void DnC (int k){
25      deque<pair<int,pair<pii,pii>>> dq;
26      int lvl = 0;
27      dq.push_back({1,{{k,m},{k,m}}});
28      while (!dq.empty()){
29          auto in = dq.front();
30          int curlvl = in.fi;
31          int l = in.se.fi.fi;
32          int r = in.se.fi.se;
33          int optl = in.se.se.fi;
34          int optr = in.se.se.se;
35          dq.pop_front();
36
37          if (curlvl != lvl){
38              lvl = curlvl;
39              BIT.Init(m);
40          }
41
42          int mid = (l+r)/2;
43
44          pii best = {0,-INF};
45
46          for (int i = optl; i ≤ min(mid,optr); i++){
47              int sum = dpPrev[i-1] - precalc[mid][i-1] + precalc[mid][mid];

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48
49         if (sum > best.se){
50             best.fi = i;
51             best.se = sum;
52         }
53     }
54     dp[mid] = best.second;
55     int opt = best.first;
56
57     if (l ≤ mid-1) dq.push_back({lvl+1, {{l, mid-1}, {optl, opt}}});
58     if (mid+1 ≤ r) dq.push_back({lvl+1, {{mid+1, r}, {opt, optr}}});
59 }
60 }
```