

Harta's blog

Dynamic Programming Type

 By [Harta](#), 3 years ago,  
[Dynamic Programming \(DP\):](#)

1. Classic Dynamic Programming

a. LCS

Problem: 1. SAMER08D

b. LIS

Problem: 1. Beautiful People

2. MDOLLS

3. MSTICK

4. MCARDS

c. Edit Distance

d. Matrix Chain Multiplication

Problem: 1. Mixtures

e. Knapsack

Problem: 1. Scubadiv

2. Advance DP

a. DP k-th lexicographical string

Problem: 1. z-01 paths

2. z-board

3. Linear Garden (IOI 2008)

b. DP tree

Problem: 1. z-sumpaths

2. River (IOI 2005)

3. z-company

4. Greedy Hydra (CNOI 2002)

 5. [VOCV](#)

6. PT07F

7. PT07X

8. nagibni

c. DP+ BIT/segment tree

Problem: 1. Salesman (IOI 2009)

2. explosion

3. intervali

4. RENT

5. INCSEQ

6. INCSEQ

d. DP+ convex hull

Problem: 1. Batch Scheduling (IOI 2002)

2. NKLEAVES

→ Pay attention

Before contest

[Codeforces Round #163 \(Div. 2\)](#)

21:27:36

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8	yeputons	2558
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10	RAVEman	2545

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3. Harbingers (CEOI 2009)
4. Commando (APIO 2010)

e. DP pre-processing

- Problem: 1. Oil (APIO 2009)
2. Garden (IOI 2005)
 3. Pyramid (IOI 2006)

f. DP bitmask

- Problem: 1. Reklame
2. Chess
 3. Bond
 4. TRSTAGE
 5. HIST2
 6. LAZYCOWS

g. Problem 1: Grid (BOI 2008)

h. DP matrix multiplication/ DP using recurrence

- Problem 1. SEQ
2. SPP
 3. z-funkcija
 4. mit-indiv09-words
 5. Reading (Balkan 2009)
 6. Super Climber
 7. z-mario

i. DP+ trie

- Problem 1. MORSE

j. DP+geometry

- Problem 1. MPOLY
2. CVXPOLY
 3. MTRIAREA

k. DP + Binary Search

- Problem 1. Game (IOI 2008, Practice session)

l. DP + Knuth Optimization

- Problem 1. [Breaking Strings](#)

Other Problems in SPOJ can be found [here](#) by **pt1989**

Thanks to **pt1989**

Here are problems in [acm.sgu.ru](#) 269, 273, 304, 317, 356, 396, 445, 447, 458, 489, 494

Thanks to **natalia**

Reference:

1. Topcoder
2. Codechef

rumi13 → [Registration for Ural Championship](#)

rng_58 → [Codeforces Round #162 Tutorial](#)

Sereja → [TopCoder SRM 567](#)

rng_58 → [Codeforces Round #162](#)

Egor → [CHelper 3.3](#)

LashaBukhnikashvili → [USACO 2013 Jan. Contest](#)

sourabh912 → [SPOJ-HELPOBO](#)

diego_v1 → [USACO Contest Weighted Results](#)

MaximShipko → [Updating Trainings](#)

DoctorLai → [Newbie's mistakes](#)

anup.kalbalia → [Invitation to the January 2013 Cook-off on CodeChef](#)

professorbrill → [BFS on 0-1 graph](#)

selfcompiler → [DP problem](#)

kuruk2013 → [Online Programming Contest Kurukshetra 2013](#)

mp007 → [Custom Test problem](#)

Nerevar → [Codeforces Round #154 \(Div. 2\) and Codeforces Round #155 \(Div. 2\)](#)

HolkinPV → [Codeforces Round #161 \(Div. 2\)](#)

cegprakash → [K! Online Programming Contest](#)

osmanuss → [COCI Contest #4](#)

dtalamas24 → [Why Codeforces website stops working quite frequently?](#)

MikeMirzayanov → [Codeforces Testing Round #5](#)

MikeMirzayanov → [Frequently Asked Questions](#)

[Detailed →](#)

bitmask, dynamic programming, edit distance, lcs, lis, mcm, segment tree, tree, z-trening

+4

[Harta](#)

3 years ago

57



Comments (57)

[Write comment?](#)

3 years ago, #

0



Harta

any feedbacks are welcomed
→ [Reply](#)



Salat

3 years ago, # |
Awesome!
→ [Reply](#)

▲ 0 ▼



Hernan

3 years ago, # |
I always appreciate the problems rather than theory, thanks.
→ [Reply](#)

▲ 0 ▼



Harta

3 years ago, # |
Some others are recommended by Amtrix
→ [Reply](#)

▲ 0 ▼



vdmedragon

3 years ago, # |
DP using recurrence:
<http://www.spoj.pl/problems/SEQ/>
<http://www.spoj.pl/problems/SPP/>

▲ 0 ▼

Can I save ur link into my blog?
→ [Reply](#)



Harta

3 years ago, # ^ |
Sure
→ [Reply](#)

▲ 0 ▼

3 years ago, # ^ |
LIS: MDOLLS, MSTICK (SPOJ)

▲ 0 ▼



vdmedragon

DP + BIT/Segment tree: INCSEQ, INCSEQ, RENT (SPOJ),
Intervalli (z-trenning).

BIT: HELPBOB, HIST2 (SPOJ)

→ [Reply](#)



Harta

3 years ago, # ^ |
I think HIST2 suits to DP+bitmask
→ [Reply](#)

▲ 0 ▼



3 years ago, # ^ |
LIS: MCARDS (SPOJ).
LCS : <https://www.spoj.pl/problems/SAMER08D/>
DP + tries: MORSE (SPOJ)

▲ 0 ▼

→ [Reply](#)

vdmedragon

→ [Reply](#)

vdmedragon

3 years ago, # ^ |

▲ 0 ▼

DP+geometry: MPOLY, CVXPOLY, MTRIAREA (SPOJ)
→ [Reply](#)



vdmedragon

3 years ago, # ^ |

▲ 0 ▼

some more

: [http://pt1989.22web.net/c0ding/spoj.php?](http://pt1989.22web.net/c0ding/spoj.php?search=dp)

search=dp (thanks to Pratik)

→ [Reply](#)

Harta

3 years ago, # ^ |

▲ 0 ▼

Added thx

→ [Reply](#)

cmd

3 years ago, # |

▲ 0 ▼

LIS:

<http://acm.sgu.ru/problem.php?contest=0&problem=199>→ [Reply](#)

Harta

3 years ago, # ^ |

▲ 0 ▼

Thx ^^

→ [Reply](#)

Harta

3 years ago, # |

▲ 0 ▼

zillion thanks to all contributors

→ [Reply](#)

spocoder

3 years ago, # |

▲ 0 ▼

does this problem have own type ? <http://www.spoj.pl/problems/ZUMA/>→ [Reply](#)

w0rm

3 years ago, # |

▲ 0 ▼

awesome ,thanks man

→ [Reply](#)

w0rm

3 years ago, # |

▲ 0 ▼

more problems: [http://www.topcoder.com/tc?](http://www.topcoder.com/tc?module=ProblemArchive&sr=&er=&sc=&sd=&class=&cat=Dynamic+Programming&div1=&div2=&mind1s=&mind2s=&maxd1s=&maxd2s=&wr=)

module=ProblemArchive&sr=&er=&sc=&sd=&class=&cat=Dynamic+Programming&div1=&div2=&mind1s=&mind2s=&maxd1s=&maxd2s=&wr=

→ [Reply](#)

3 years ago, # |

▲ 0 ▼

Thanks.

→ [Reply](#)



ctna

3 years ago, # |

▲ 0 ▼



codewarrior

i was solving problem of cutting sticks frm UVA.....i used some method tht was wasting lot of memory...i came to read tht this problem is exactly similar to the matrix chain multiplication problem bt i cant figure out the similarity between the two....can anyone help....the approach i used was to have all $1 < n$ subsets as the "states" of DP...obviously its space requirement is tooo high...

thnx in advance.....

→ [Reply](#)



baukaman

3 years ago, # |

▲ 0 ▼

Great!

something about graph theory ?

→ [Reply](#)



simpleton

3 years ago, # |

▲ 0 ▼

Hi,

It seems that you added the problem NKLEAVES on ztrening. Can I know where you got the testcases from? I got 2 cases wrong (testcase 3 and 8) and I cannot figure out why :(.
→ [Reply](#)



Harta

3 years ago, # ^ |

▲ 0 ▼

I have sent you a message.

→ [Reply](#)



natalia

3 years ago, # |

▲ +1 ▼

some DP problems from

acm.sgu.ru: 269, 273, 304, 317, 356, 396, 445, 447, 458, 489, 494

→ [Reply](#)



Harta

3 years ago, # ^ |

▲ 0 ▼

Thank you so much :)

→ [Reply](#)



ridowan007

3 years ago, # |

▲ 0 ▼

I Love DP :)

Thanks for it

→ [Reply](#)

3 years ago, # ^ |

▲ 0 ▼

can someone suggest some game problems solved using DP? thx

→ [Reply](#)



Harta

[→ Reply](#)

3 years ago, # |

▲ 0 ▼

Try this one. It is a problem that I came across in the past. Sorry, I forgot the website and don't have the testcases :(, but I know the algorithm though XD.

You have a N bowling pins ($1 \leq N \leq 1000$) arranged in a line. The pins are represented as a string of 1s and 0s. 1 means the pin is still standing and 0 means the pin has been knocked down. Player A and B take turns to play this game, with player A moving first.



simpleton

In each of their turns, A or B chooses to knock down up to K ($1 \leq K \leq N$) consecutive standing pins down. A player can only knock down exactly one consecutive block of standing pins during his turn. He must also knock down at least 1 pin. The player who cannot make a move loses.

Given N, K , and the initial starting configuration of the pins, determine who will win under optimal play. If A will win, output the resulting configuration of the pins after A has made his move. If there are multiple moves A can make, output the move that will result in a lexicographically smallest resulting formation.

Note: You do require a bit of game theory before you can solve this problem.

[→ Reply](#)

Harta

3 years ago, # ^ |

▲ 0 ▼

ow.. thx for the problem, I just notice that someone had replied xD

[→ Reply](#)

mostafa_elabady

3 years ago, # |

▲ 0 ▼

thanks

[→ Reply](#)

bhardwajjayesh7

3 years ago, # |

▲ 0 ▼

hi,

I am facing problems with the [chess problem](#) listed above. Can anyone suggest some hints to solving the problem.

P.S: I am a newbie in DP

[→ Reply](#)

Harta

3 years ago, # ^ |

▲ 0 ▼

since M is small ($M \leq 10$) you can use bitmask.

0->no king

1->there is a king

$dp[i][state]$ where state means the state of the kings in row- i

you can add $dp[i][state1]$ with $dp[i-1][state2]$ if kings in state2 can't

attack kings in state1.

[→ Reply](#)

3 years ago, # |

▲ 0 ▼

DP + Binary Search



EmadWilliam

(Game, IOI 2008, Practice session)
→ [Reply](#)



Harta

3 years ago, # ^ |

added. Thx
→ [Reply](#)

▲ 0 ▼



bhardwajjayesh7

3 years ago, # |

thnx Harta
→ [Reply](#)

▲ 0 ▼



a70babat

2 years ago, # |

hi,
can you say some hints for problem [MTRAREA](#)? is there any solution better than $O(n^2)$?
→ [Reply](#)

▲ 0 ▼



it4.kp

2 years ago, # ^ |

You can solve it in $O(n \log(n))$. First find a convex hull, and then use the method described [here](#).
→ [Reply](#)

▲ 0 ▼



a70babat

2 years ago, # ^ |

thanks. beautiful idea! I was trying to solve it using DP. does it have any efficient solution using DP?
→ [Reply](#)

▲ 0 ▼



Mehrdad

2 years ago, # |

hi,
What is DP + Knuth Optimization?
→ [Reply](#)

▲ 0 ▼



Harta

2 years ago, # ^ |

Hopefully [this](#) will help :)
→ [Reply](#)

▲ 0 ▼



Mehrdad

2 years ago, # ^ |

Thanks
→ [Reply](#)

▲ 0 ▼



EmadWilliam

2 years ago, # |

How to solve MIXTURES in a complexity better than $O(n^3)$?
→ [Reply](#)

▲ 0 ▼



kletoskletos

23 months ago, # ^ |

▲ 0 ▼

Do you mean the $O(n \log n)$ algorithm? Or is there something easier?
 → [Reply](#)



fataluk1

2 years ago, # |

▲ 0 ▼

Anyone got a clue on how to approach The Greedy Hydra problem? It seems tough :|
 → [Reply](#)



simp1eton

2 years ago, # ^ |

▲ 0 ▼

If the number of colours ≥ 3 , you can always colour the edges in such a way that no fruits are eaten. Just alternate the colouring.

If the number of colours $= 2$, then you write the N^3 dp.
 → [Reply](#)

23 months ago, # |

← Rev. 4 ▲ 0 ▼

Very useful content.
 Thanks!



Anurag

I will mention my update whenever i solve any problem from above.

1. c. Edit Distance - Done Source Code

How to tackle array sizedeclaring $dp[2000][2000]$ gives seg. fault?

[Tutorial on Edit Distance](#)

[Algo](#)
 → [Reply](#)



ron2794

4 weeks ago, # ^ |

▲ 0 ▼

the problem will be solved if you increase the size to 3000, same happened with me too.

Just take a global static int of size 3000.
 → [Reply](#)



scofield23

21 month(s) ago, # |

▲ 0 ▼

can u tell the level of difficulty too..
 → [Reply](#)

18 months ago, # |

▲ 0 ▼

Hi



iscsi

Can anybody help me what is the problem with my [solution](#) for the mixtures problem? (I've got WA)

(I've checked spoj forum and my solution is correct those test case.. :()
 → [Reply](#)



Oleg

18 months ago, # ^ |

▲ +1 ▼

Seems it won't even pass example input. There can be multiple input in single file - you read only first one.
 → [Reply](#)



iscsi

18 months ago, # ^ |

▲ 0 ▼

Thank you, it's a shame :(I was careless sry..
→ [Reply](#)



EssamMNaggar

15 months ago, # ^ |

▲ 0 ▼

That was my bug too, Hi 5 ! LOL :D
→ [Reply](#)



f.nasim

11 months ago, # ^ |

▲ 0 ▼

Also mine. :)
→ [Reply](#)



Inf_Zero

17 months ago, # |

▲ 0 ▼

Is there something wrong with z-trening!!!!
please provide some alternative(judge) for the z-trening problems in above list
→ [Reply](#)



keivan

6 months ago, # ^ |

▲ 0 ▼

I have the same problem .
→ [Reply](#)



sergio3010

5 months ago, # ^ |

▲ 0 ▼

same problem here.
→ [Reply](#)



ron2794

4 weeks ago, # |

▲ 0 ▼

For editDistance problem in above for which you haven't added any problem, you can add this problem :

<http://www.spoj.com/problems/EDIST/>
→ [Reply](#)