Harta's blog

Dynamic Programming Type

By **Harta**, 7 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. INCDSEQ

d. DP+ convex hull

Problem: 1. Batch Scheduling (IOI 2002)
2. NKLEAVES
3. Harbingers (CEOI 2009)
4. Commando (APIO 2010)

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ACMath → ACM ACPC 2016: Live Scoreboard & Broadcast

k790alex → Latin America Regional Contest 2016

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

rng_58 → AtCoder Grand Contest 007

Egor → CHelper 4.1

Al.Cash → Efficient and easy segment trees

shubhinanugullu → Partition an even sized multi-set of whole numbers into two multi-sets of equal size having almost equal sums

snarknews → OpenCup GP of Eastern Europe

belowthebelt → November Clash 2016

shubhinanugullu → Efficiently find maximum XOR on a graph

csacademy → Round #14 (Div. 2)

mo7amed_a7med → 337A How to apply dynamic programming

shubhinanugullu → An assignment problem. Please tell an efficient algorithm for the following problem:

appa → My name is Hongjun Jang.

DuckLadyDinh → Any solution to the problem of 'aging'?

Nickolas → e-maxx translation news + Hacktoberfest = T-shirts!

gKseni → Moscow International Workshop ACM ICPC 2016 hosted by MIPT

rjalfa0 → Script for Converting Polygon ZIPs to Domjudge ZIPs

MikeMirzayanov → 2016-2017 CT S03E09: Codeforces Trainings Season 3 Episode 9

gKseni → Codeforces announces contest for the best motto for laptop stickers

shakil → How to become red from green?

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

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

+4 Harta 7 years ago 73

Comments (73)

Write comment?

7 years ago, # | 0

any feedbacks are welcomed

→ Reply

Harta

7 years ago, # | 0

Awesome!

→ Reply

Salat

7 years ago, # | ▲ 0 ▼

I always appreciate the problems rather than theory, thanks.

→ Reply

Hernan

7 years ago, # | ▲ 0 ▼

Some others are recommended by Amtrix

→ Reply

Harta

7 years ago, # | ▲ 0 ▼

DP using recurrence:
http://www.spoj.pl/problems/SEQ/
http://www.spoj.pl/problems/SPP/

Can I save ur link into my blog?

→ Reply

vdmedragon

7 years ago, # ^ | ▲ 0 ▼

Sure

→ Reply

Harta

7 years ago, # ^ | ▲ 0 ▼

LIS: MDOLLS, MSTICK (SPOJ)

vdmedragon

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

BIT: HELPBOB, HIST2 (SPOJ)

→ Reply

Harta

7 years ago, # ^ | 0

I think HIST2 suits to DP+bitmask

→ Reply

vdmedragon

7 years ago, # ^ | 0

LIS: MCARDS (SPOJ).
LCS : https://www.spoj.pl/problems/SAMER08D/
DP + tries: MORSE (SPOJ)

→ Reply

vdmedragon

7 years ago, # ^ | 0

DP+geometry: MPOLY, CVXPOLY,MTRIAREA (SPOJ)

→ Reply

vdmedragon

7 years ago, # ^ | 0

some more
: http://pt1989.22web.net/c0ding/spoj.php?search=dp (thanks to Pratik)

→ Reply

Harta

7 years ago, # ^ | 0

Added thx

→ Reply

cmd

7 years ago, # | 0

LIS:
http://acm.sgu.ru/problem.php?contest=0&problem=199

→ Reply

Harta

7 years ago, # ^ | 0

Thx ^^

→ Reply

Harta

7 years ago, # | 0

zillion thanks to all contributors

→ Reply

spcoder

6 years ago, # | 0

does this problem have own type ? http://www.spoj.pl/problems/ZUMA/

→ Reply

w0rm

6 years ago, # | 0

awesome ,thanks man

→ Reply

6 years ago, # | 0

w0rm

more problems: http://www.topcoder.com/tc?module=ProblemArchive&sr=&er=&sc=&sd=&class=&cat=Dynamic+Programming&div1l=&div2l=&mind1s=&mind2s=&maxd1s=&maxd2s=&wr=

→ Reply

ctna

6 years ago, # | ▲ 0 ▼

Thanks.

→ Reply

codeworrior

6 years ago, # | ▲ 0 ▼

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

6 years ago, # | ▲ 0 ▼

Great!

something about graph theory ?

→ Reply

6 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

simp1eton

figure out why :(.

→ Reply

Harta

6 years ago, # ^ |

0

I have sent you a message.

→ Reply

natalia

6 years ago, # |

+1

some DP problems from

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

→ Reply

Harta

6 years ago, # ^ |

0

Thank you so much :)

→ Reply

ridowan007

6 years ago, # |

0

I Love DP :)

Thanks for it

→ Reply

Harta

6 years ago, # ^ |

0

can someone suggest some game problems solved using DP? thx

→ Reply

6 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<=N<=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.

simp1eton

In each of their turns, A or B chooses to knock down up to K (1<=K<=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

6 years ago, # ^ | 0

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

→ Reply

6 years ago, # | 0

thanks

→ Reply

mostafa_elabady

6 years ago, # | 0

hi,
I am facing problems with the chess problem listed above. Can anyone suggest some hints to solving the problem.

bhardwajjayesh7

P.S: I am a newbie in DP

→ Reply

6 years ago, # ^ | 0

Harta

since M is small (M<=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

6 years ago, # | 0

DP + Binary Search
(Game, IOI 2008, Practice session)

→ Reply

EmadWilliam

6 years ago, # ^ | 0

added. Thx

→ Reply

Harta

6 years ago, # | 0

bhardwajjayesh7

thnx Harta

→ Reply

a70babat

6 years ago, # | ▲ 0 ▼

hi,
can you say some hints for problem MTRAREA? is there any solution better than O(n^2)?

→ Reply

it4.kp

6 years ago, # ^ | ▲ 0 ▼

You can solve it in O(n*log(n)). First find a convex hull, and then use the method described here.

→ Reply

a70babat

6 years ago, # ^ | ▲ 0 ▼

thanks. beautiful idea! I was trying to solve it using DP. does it have any efficient solution using DP?

→ Reply

Mehrdad

6 years ago, # | ▲ 0 ▼

hi,
What is DP + Knuth Optimization?

→ Reply

Harta

6 years ago, # ^ | ▲ 0 ▼

Hopefully this will help :)

→ Reply

Mehrdad

6 years ago, # ^ | 0

Thanks

→ Reply

EmadWilliam

6 years ago, # | 0

How to solve MIXTURES in a complexity better than O(n^3) ?

→ Reply

kletoskletos

6 years ago, # ^ | 0

Do you mean the O(n*logn) algorithm?Or is there something easier?

→ Reply

fataluk1

6 years ago, # | 0

Anyone got a clue on how to approach The Greedy Hydra problem? It seems tough :|

→ Reply

simp1eton

6 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

6 years ago, # | ← Rev. 4 0

Very useful content.
Thanks!

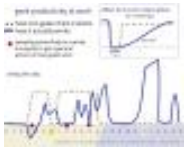
Anurag

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

1. c. Edit Distance - Done Source Code
   How to tackle array size .....declaring dp[2000][2000] gives seg. fault?
   Tutorial on Edit Distance
   Algo

→ Reply

4 years ago, # ^ | 0



ron2794

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

6 years ago, # | 0

can u tell the level of difficulty too..

→ Reply

5 years ago, # | 0

iscsi

Hi

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

5 years ago, # ^ | +1

Seems it won't even pass example input. There can be multiple input in

single file - you read only first one.

→ Reply

Oleg

5 years ago, # ^ | 0

Thank you, it's a shame :(I was careless sry..

→ Reply

iscsi

5 years ago, # ^ | 0

That was my bug too, Hi 5 ! LOL :D

→ Reply

naggar

5 years ago, # ^ | 0

Also mine. :)

→ Reply

f.nasim

5 years ago, # | 0

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

→ Reply

Inf_Zero

4 years ago, # ^ | 0

I have the same problem .

→ Reply

keivan

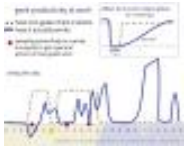
4 years ago, # ^ | 0

same problem here.

→ Reply

sergio3010

4 years ago, # | 0



ron2794

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

4 years ago, # | +3

Hello,

Any useful link,tutorial to get idea about Digit DP?

Nourin_Eka

To solve problem like those here:

http://www.lightoj.com/volume_showproblem.php?problem=1122

http://www.lightoj.com/volume_showproblem.php?problem=1122

http://www.lightoj.com/volume_showproblem.php?problem=1125

THanks :)

→ Reply

4 years ago, # ^ | +1

Shafaet

I don't know what you meant by "digit dp" but these are very simple dp problems. For example in "1122 — Digit Count" your state can be (number of digits taken so far, last digit taken), now you can just add new numbers if it is valid, go to next state and add the answers.

→ Reply

4 years ago, # ^ | 0

For the problem 1125, your DP should have three states like [current position of the array][how many left to take][remainder of the sums of the chosen elements].

suppose you are in a state like this [25][2][5]

shakil

then you can either

1. take the 25th element and add it to remainder and mod it which will take you to the state [26][1][(5+X[25] + mod)%mod]

2. or you can skip it and go to the next state which will be then [26][2][5]

By this way you can figure out all the possible combinations.

Here is my source code -->

→ Reply

14 months ago, # ^ | ← Rev. 2 0

Mr.Awesome

In your code you did something like this ((mod+arr[pos])%d) +d)%d why ??

isn't this enough (mod+arr[pos])%d because x%d always >=0 , right ??

UDP : i got it , numbers can be negative , that's why .

→ Reply

4 years ago, # | 0

Awesome!!!!!!

→ Reply

Robert

3 years ago, # | +7

why the links to problems not found? who can helpme? I need try resolve many exercise of DP... sorry for my english...

→ Reply

charlie

3 years ago, # ^ | +1

This post is 3 years old, and hasn't been updated since a moment. So it isn't surprising that some links doesn't exist anymore. After a little search on google, it seems that "z-trening" can't be found. But for the links who reference to a problem on spoj/codeforces/topcoder, there must be no problem.

→ Reply

cup_of_tea

3 years ago, # ^ | 0

I can see that, z-treining references not work, you can tellme where I can try Harbingers (CEOI 2009) exercise, thanks for your help!!

→ Reply

charlie

3 years ago, # ^ | 0

For this precise task: http://www.ceoi2009.ro/tasks/harbingers.pdf Else, if you want more archive for CEOI: http://ceoi.inf.elte.hu/tasks-archive/

→ Reply

cup_of_tea

3 years ago, # | 0

hi guys very new to this field...Can someone explain me what is the segment in the first problem in the post...i.e the problem based on LCS topic

gaurav81

→ Reply

R.A.X

2 years ago, # | 0

Can anyone provide me some hints to solve this problem:-
http://www.spoj.pl/problems/TRSTAGE/

→ Reply

123virat.sharma

22 months ago, # ^ | 0

BitMask!!! :P ;)

→ Reply

patience

22 months ago, # | 0

i need some list of lcs related dp problem.. thanks in advance

→ Reply

omarfarhat97

9 months ago, # | -11

mohieddine we start doing those tomorrow?

→ Reply

Jima

6 months ago, # | 0

great problem set , but one big problem when i solve problems is that after hours i can't solve some hard problem for me try to find algorithm but there is nothing to find solution,it's sometimes wasted time. can someone tell me how to find solutions(tutorial) for exapmle spoj great problems.?? thanks.

→ Reply

4 months ago, # | ← Rev. 3 0

Some edit distance problems. Edit distance Aibohphobia Longest Palindrome

ROWDY

Creating Palindrome

→ Reply
