

ENS Lyon Training Camp. Day 05.

30 October 2015

Problem A. «Alarm Clock»

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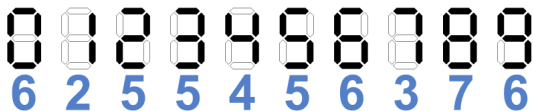
Problem

- You are given number of segments on a clock
- You need to find the time



Solution

- Calculate the number of segments



- Check all possible times hh:mm
 - hh: from 0 to 23
 - mm: from 0 to 59

Problem B. «Buffcraft»

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Problem

- You are given the list of buffs
 - direct
 - percentage
- The stats is calculated by:
$$(b + d_1 + \dots + d_n) \cdot (100 + p_1 + \dots + p_m) / 100$$
- You need to obtain maximum with $n + m \leq k$

Solution

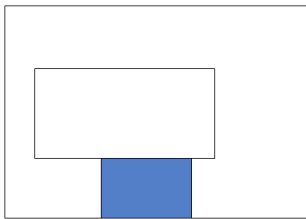
- You are given n and m
- You need to take the biggest d_i and p_i
- Sort d and p in decreasing order and precalculate prefix sums
- Check all $n + m = k$, print maximum
- The total time: $O(n \cdot \log(n))$

Problem G. «Grave»

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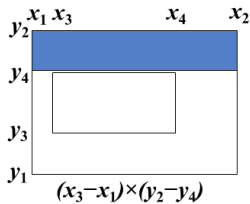
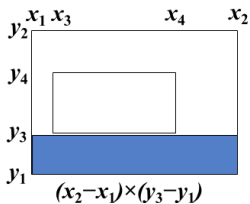
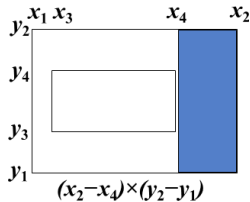
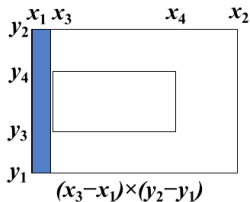
Problem

- You are given rectangle with rectangular hole
- You need to put rectangle $w \times h$ somewhere



Solution

Maximal rectangles:



Solution

- New rectangle should fit in one of maximal rectangles
- The total time: $O(1)$

Problem E. «Ballot Analyzing Device»

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Device»

Problem

- You are given:
 - The list of candidates
 - The list of filled bulletins
- You need:
 - Sort by the percent of votes
 - Calculate the number of invalid bulletins

Solution

- Check the bulletins on incorrectness:
 - No marks
 - More than one mark
- Calculate the number of votes for each candidate

Problem F. «Energy Tycoon»

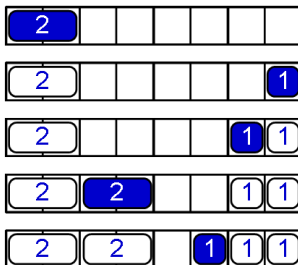
Problem F. «Energy Tycoon»

Problem

- You are given:
 - The field $1 \times n$
 - The list of power plants of length 1 or 2
- You need:
 - Plan of power plants construction
 - Calculate the maximum score

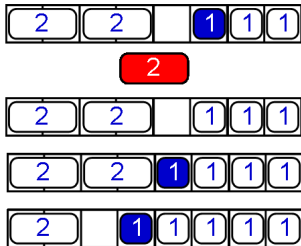
Solution

- 1 in the end
- 2 in the start
- While there is no conflict



Solution

- 1 put always, maybe instead of some 2
- Do not put 2, if there is conflict



Problem G. «Garage»

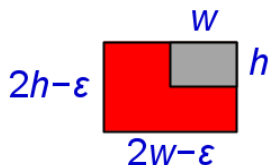
Problem G. «Garage»

Problem

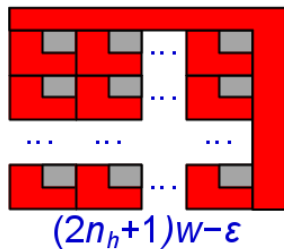
- Given:
 - Garages of size $w \times h$
 - A sandlot of size $W \times H$
- Task:
 - Put as few garages as possible such that no more garages can be added

Solution

- A «prohibited zone»



$$(2n_h + 1)h - \varepsilon$$

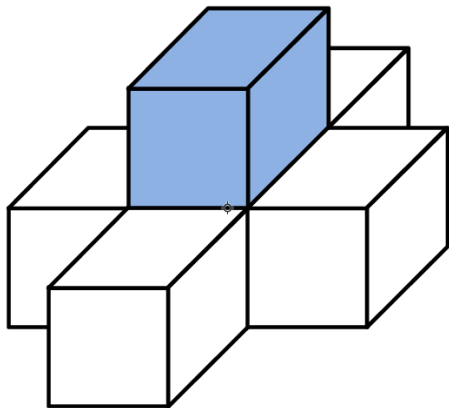


- The answer: $\lfloor (W + w)/(2w) \rfloor \lfloor (H + h)/(2h) \rfloor$

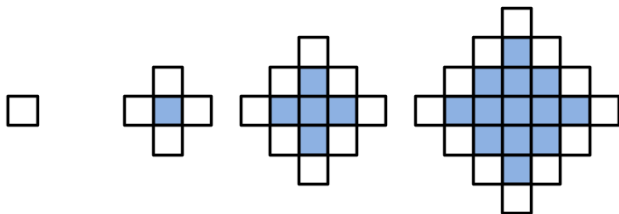
Problem H. «Aztec Pyramid»

Problem H. «Aztec Pyramid»

Problem



Solution



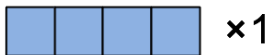
h	1	2	3	4
δs	–	4	8	12
S	1	5	13	25
V	1	6	19	44

Problem I. «Battleship»

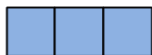
Problem I. «Battleship»

Problem

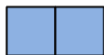
1	2	3	4	5	6	7	8	9	10
36	37	28	39	40	41	42	43	44	11
35	64	65	66	67	68	69	70	45	12
34	63	84	85	86	87	88	71	46	13
33	62	83	96	97	98	89	72	47	14
32	61	82	95	100	99	90	73	48	15
31	60	81	94	93	92	91	74	49	16
30	59	80	79	78	77	76	75	50	17
29	58	57	56	55	54	53	52	51	18
28	27	26	25	24	23	22	21	20	19



×1



×2



×3



×4

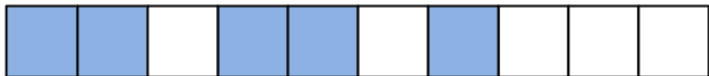
Solution

The last shot goes to...

1	2	3	4	5	6	7	8	9	10
36	37	28	39	40	41	42	43	44	11
35	64	65	66	67	68	69	70	45	12
34	63	84	85	86	87	88	71	46	13
33	62	83	96	97	98	89	72	47	14
32	61	82	95	100	99	90	73	48	15
31	60	81	94	93	92	91	74	49	16
30	59	80	79	78	77	76	75	50	17
29	58	57	56	55	54	53	52	51	18
28	27	26	25	24	23	22	21	20	19

Solution

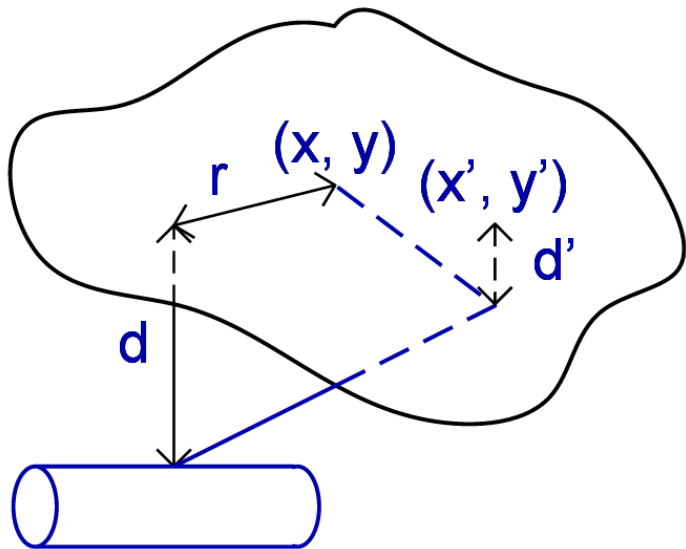
The rest of ships can be put like:



Problem J. «Deepest Station»

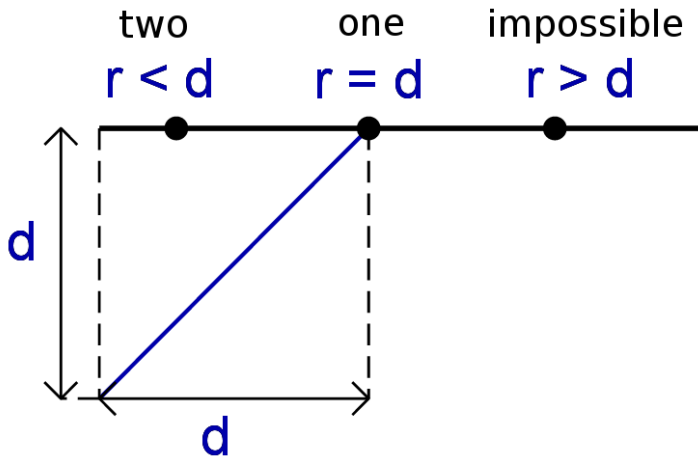
Problem J. «Deepest Station»

Problem



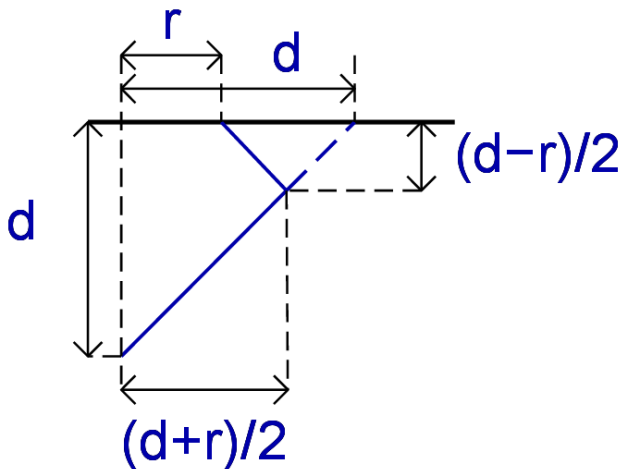
Solution

The cases



Solution

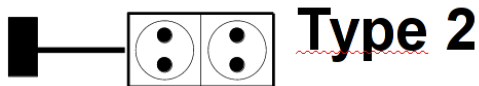
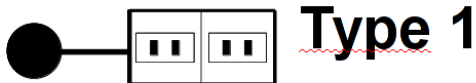
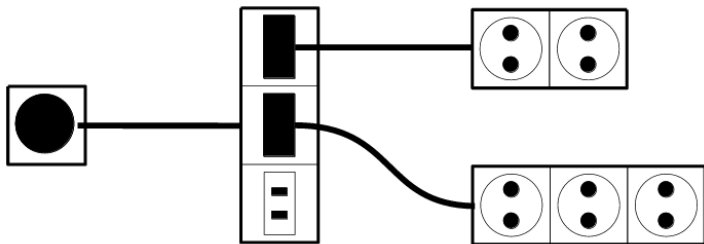
How to put two escalators



Problem K. «Electricity»

Problem K. «Electricity»

Problem



Solution

- Do we have Type 2?
 - Yes → Can we plug it?
 - Yes → Plug it!
 - No → Do we have Type 1?
 - Yes → Plug it!

Always give priority to power strips with bigger number of sockets

Problem L. «Final Standings»

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Problem

- Given:
 - n , the number of drivers
 - p , the total number of points earned by all drivers
 - k , the number of top drivers
 - d , the number of different points earned by the top drivers
- Task:
 - Restore the final standings
 - ... or tell if it is impossible

Solution

- The minimum number of points corresponds to this scheme: $d, (d - 1), \dots, 1, 0, \dots, 0$
- The minimum total number of points: $d(d - 1)/2$
- $p < d(d - 1)/2 \rightarrow$ impossible
- $p = d(d - 1)/2 \rightarrow$ follow the scheme
- $p > d(d - 1)/2 \rightarrow$ extra points go to the best driver

Questions?