

ADDITIONAL COMPETITION
FOR JUNIOR TEAM
2011.

ALGORITHM DESCRIPTIONS

ADDITIONAL COMPETITION 2011.	Task PLUSEVI

Following simple algorithm is enough for all points on this task: start from every possible center of plus and increase its size as long as it remains valid plus than move to center of next plus and repeat the same.

On first look, this algorithm seems to have complexity $O(N^4)$ in worst case – picking up center of plus has complexity $O(N^2)$ and increasing size has complexity $O(N^2)$ – but it doesn't. Every cell of the matrix with this algorithm will be visited at most 4 times because one spot can belong to at most four plusses. So, complexity of this algorithm is $O(N^2)$.

Necessary knowledge for solving:

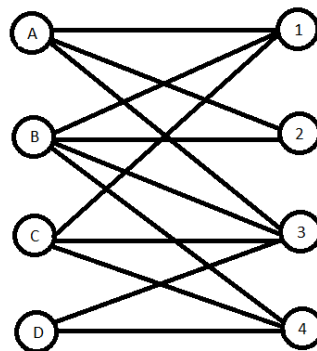
Work with matrixes

Category

Ad hoc

ADDITIONAL COMPETITION 2011.	Task SELA

In this task it is necessary to find four villages which are all connected (all villages on one side of the river are connected directly, and connection between village on left and village on right side is ship – bipartite graph):



In this case it is enough to find out for every pair of villages on left side how many villages on the right side are connected to both of it. After finding it out, number of valid combinations of four villages which includes starting two villages on the left side is easy to calculate. Complexity for this solution is ($O(N^3)$), which is not good enough for 100 points (brought 78 points). Final solution is the same as this one, just speeded up using bit masks. The idea is to represent X villages on the right side with one integer. As example, in graph above connections for villages on the left side can be represented as {1110, 1111, 1011, 0011}, or as integers {14, 15, 11, 3}. Common villages on right side for two villages on the left side can now be easily get using logical AND operator (common villages for A and B are 14 AND 15 = 14). At the end it is necessary to count number of ones in integers which is precomputed for speeding up 20 times (precomputing for integers 0- 2^{20}) .

Necessary knowledge for solving:

Combinatoric basics. Bit masks, logical binary operations

Category

Ad hoc