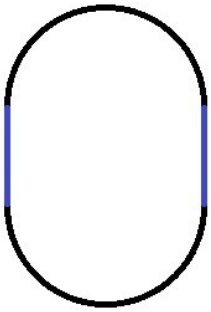
IVIQ Round 4 (optimization)

1) Using 3 straight lines of length R and 12 circle eighths of radius R construct maximum number of different almost closed tracks. Almost closed means that distance between endpoints must be lower than 0.2R. Tracks obtained by rotation or mirrorization are NOT considered different.

   Example with 2 straight lines and 8 circle eighths:



   Answer key:
   Write S for straight line, CL for circle eighth going anticlockwise and CR for circle eighth going clockwise. So, one possible answer key for given example is S, CR, CR, CR, CR, S, CR, CR, CR, CR.

2) Using exactly four 8s (and no other digits), elementary mathematical operations (addition, subtraction, multiplication, division, exponentiation) and parentheses construct m expressions with distinct values in the set of positive integers. Let n be the maximum of those values. Maximize $1.5m - 0.5n$.

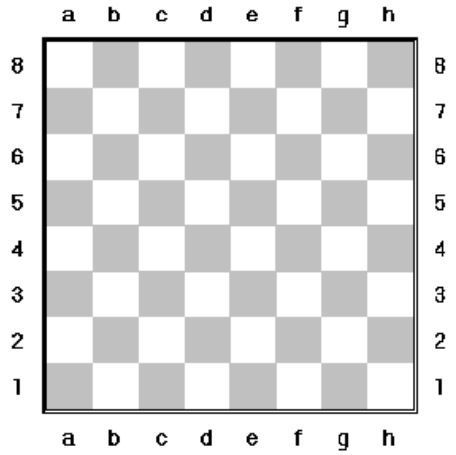
   Example with value 0:
   $0 = \frac{8}{8} - \frac{8}{8}$
   There is no need for special answer key here.

3) Find maximum number of logical explanations how to complete the sequence: 1, ?, V, ?

   There is no need for special answer key here.

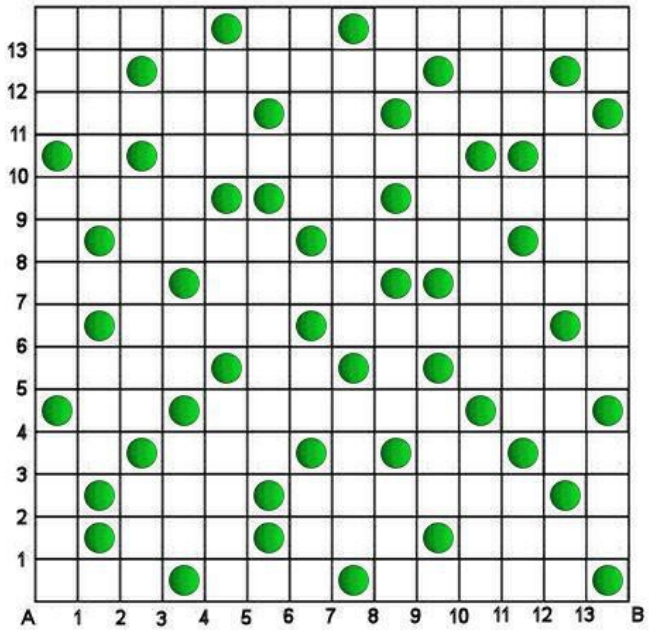
4) Place certain number of chess pieces on the standard chess board (8x8). Each piece may be attacked by at most three other pieces. Maximize $360Q + 224R + 140B + 105K + 84Kn + 28P$, where :

$Q =$number of queens,
$R =$number of rooks,
$B =$number of bishops,
$K =$number of kings,
$Kn =$number of knights,
$P =$number of pawns.

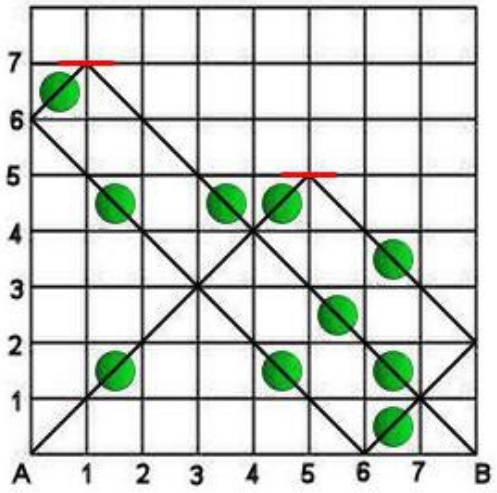


Answer key:
Use any notation, but explain it.

5) Place certain number of two-sided mirrors into the grid so that laser beam goes diagonally from point A to point B and through all green balls. Laser beam reflects from mirrors and from sides of given area. Minimize the number of mirrors.



Example with 2 mirrors:



Answer key:

Write coordinates and orientation for each mirror. Orientation is H (horizontally) or V (vertically). So, answer key for given example is: (1,7,H), (5,5,H).

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