Creative task 1: Colonel Blotto Tournament

Deadline: April 7th, 23:59.

The problem: "In a distant, war-torn land, there are 10 castles. There are two warlords: you and your archenemy. Each castle has its own strategic value for a would-be conqueror. Specifically, the castles are worth 1, 2, 3, ..., 9, and 10 victory points. You and your enemy each have 100 soldiers to distribute, any way you like, to fight at any of the 10 castles. Whoever sends more soldiers to a given castle conquers that castle and wins its victory points. If you each send the same number of troops, you split the points. You don't know what distribution of forces your enemy has chosen until the battles begin. Whoever wins the most points wins the war."

This problem is not an original one, it was formulated as a contest for readers of website FiveThirtyEight (hence the quotation marks). The FiveThirtyEight website is well known for providing forecasts of various political and sports events. On a weekly basis it publishes "The Riddler" column, which asks variety of questions meant to be answered using creative thinking and/or computational methods. We will use their post "Can you rule Riddler nation?" [`https://fivethirtyeight.com/features/can-you-rule-riddler-nation/`], from which the above excerpt was taken, as a basis for our own tournament.

Originally Blotto game is a type of two-person constant-sum game studied by Game Theory. In simple terms, Game Theory is a branch of mathematics that studies strategic interactions between rational decision makers. What is fascinating about this game is that it is not known if it has an optimal strategy. May be one of you will discover such strategy!

The original competition asked competitors to provide fixed battle plans (vector of 10 numbers). Therefore the winner could be determined in a single war.

For example, among the strategies used in the first competition were these two:

$$\vec{A} = (5, 12, 17, 13, 13, 11, 13, 5, 4, 7)\,,$$
$$\vec{B} = (3, 3, 13, 13, 3, 13, 13, 18, 3, 18)\,.$$

In a war between these two strategies $\vec{B}$ would win. As warlord using $\vec{B}$ strategy would control 6th, 8th and 10th castle (for $6 + 8 + 10 = 24$ points). On the other hand warlord using $\vec{A}$ strategy would control 1st, 2nd, 3rd, 5th and 9th castle ($1 + 2 + 3 + 5 + 9 = 20$ points). In 4th and 7th castle warlords would be drawn ($\frac{4+7}{2} = 5.5$ points each). The final result would be $25.5 : 29.5$.

Our competition will be slightly different. The winner will be the warlord winning more wars in the 1001 war series against his opponent. As in football, the winner will get 3 points and the loser 0 points, in case of a draw both players will get 1 point. Deciding after that many wars allows for random and adaptive strategies. Therefore you are encouraged to formulate such strategies.

Your strategy should be implemented as a Matlab function accepting two variables: matrix of plays made by you and matrix of plays made by your opponent (both of size $(i-1) \times 10$ with i being current war number). Your function must return a vector, $\vec{V}$, of 10 numbers. Each V_i is assumed to be a number of soldiers assigned to the castle worth i points.

```
1  function play = JB007(my_plays, op_plays)
2  % Function generates plays based on my strategy, which is ...
3  %
4  % Author: James Bond
5  %
6  % Input args:
7  % * my_plays - history of plays made by me
8  % * op_plays - history of plays made by my opponent
9  % Output arg:
10 % * play     - soldier assignments
11 %
```

```
12
13 end
```

Note that function name must be your two initials ("**J**ames **B**ond" uses "**JB**") and last three numbers of your student ID number ("James Bond" is "**007**"). If you need to define helper functions, you may store them in separate files. Their names should start with the same 5 symbols as your main function name (for example, "**JB007**_helper"). The provided template and basic example of a strategy will be uploaded to the e-learning platform.

In the tournament everyone will compete against everyone in exactly one series of 1001 wars. Code used to run the tournament will be made available on e-learning platform.

Important! Your code shouldn't be larger than 100KB. Your code shouldn't read/write files, but you may use persistent variables. These will be cleared after each war.

Your grade, G, will be based on two factors: performance against your peers, F_{peers}, and quality of your approach, F_{qual},

$$G = \frac{F_{peers} + F_{qual}}{2}.$$

Performance will be judged by your ranking, R, among your peers (given that there are N students):

$$F_{peers} = 6 \cdot \frac{N - R}{N - 1} + 4.$$

Quality of your approach will be judged by the instructors $(0 - 10)$. We will judge the idea, the skill and the presentation in equal parts. Your approach should interesting, motivated, well coded and properly explained.