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### Summit (a dice game)

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In this étude you will develop a strategy for playing the dice game *Summit*, invented specifically for this étude. The rules of *Summit* are given below.

I will provide a framework that allows you to run tournaments among different players. You are encouraged to use this to evaluate and refine your strategies. If you wish to share your strategy with other groups, that's fine – but please treat such sharing as a “black box”, i.e., do not inspect or use the code from other groups' work.

The town hall on September 27 will feature a tournament among your strategies, so code must be submitted no later than the end of the day on September 24.

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## Rules

### Overview

*Summit* is a betting game that can be played by two or more players. Each player has a *hand* consisting of five dice (not visible to the other players). The game consists of a sequence of *rounds* each of which ends with a *showdown*. During a round each active player has a *bet* in front of her, and there may also be a *pot* consisting of parts of the bets of players who are no longer involved in the round. When a showdown occurs, the active player who has the greatest sum of the dice in her hand at that point collects all the remaining bets and the pot.

### Starting a round

Each player rolls her dice to get an initial hand. In clockwise order around the table the players place initial bets of  $1, 2, \dots, n - 1$  chips (where  $n$  is the total number of players). The action begins with the player who has not yet placed a bet.

### Action

When it is your turn to act you may *drop out*. In this case your total bet is divided by the number of players remaining in the round. The result is rounded up, and that amount is added to the pot. The rest of your bet returned to you and you take no further part in the round. So, for example, if there are four players left in the round and you have bet 7 chips so far then, if you drop out, 2 chips from your bet are added to the pot, and 5 are returned to you.

If you do not fold immediately then you must increase your bet so that your total bet is exactly one more than the largest bet of any other player still in the round. Then you have two choices: to take a roll, or call a showdown.

If you take a roll, a single die is rolled openly. If it shows a value greater than the least of your dice, then it replaces that value. Everyone sees what was rolled, and the fact that it replaced one of your dice, but not the value it replaces. If it shows a value less than or equal to the least of your dice, no change is made to your dice. Again, everyone sees what was rolled, and is aware that your dice were not changed.

If you call a showdown, each player remaining in the round may stay or exit. If he exits, half his bet (rounded up) is added to the pot (and the remainder returned to him). The players who elect to stay compare the totals on their dice. The player with the largest total collects the pot and all the remaining bets. In the case of a tie the player with the largest bet among the tied players wins. Note that the rules ensure that no two players can ever have the same bet in front of them.

### **Next round**

After a showdown the next round is played, rotating the initial bets one position clockwise. In other words, your initial bet goes down by 1 unless you began this round in which case it becomes  $n - 1$ .

### **The end of the game**

After a fixed number of rounds, which is a multiple of the total number of players, the game ends, and the winnings or losses of the various players are compared. Players are assumed to have deep pockets and cannot go broke.

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### **Task**

- Choose a team name.
- Submit a project diary. This should be a PDF file which informally documents your work (it could well include, e.g., scanned handwritten notes and comments like “Stuck because of a bug the tournament framework”).
- Submit one or more implementations of the `summit.Player` interface (details to follow on this). The name of your implementation should be `TeamName.java` (with the obvious substitution!) and it should be part of the `summit` package.

- Submit a short formal report (from one to two sides of A4 at 10 to 12 point size for the body text) that explains your strategy and the processes you used to come up with it. Think of this as a sales pitch to a client who is not only interested in the direct comparisons between competing versions of the current product, but of evidence about good processes for future projects.

(3 point, Group)