The Unfair Dice Problem (Hands-On Activity)

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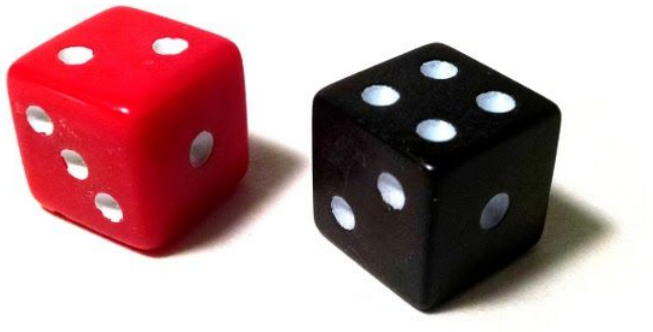

Activity summary

The unfair dice problem is a free resource for teachers and students, and is part of the Callysto project, a federally-funded initiative to bring data science skills into Grade 5-12 Canadian classrooms.

In this activity students will use an online Callysto notebook, which simulates an unfair dice game. This can be done with students in person, or, online.

Grade level

This activity is best suited for students in Grades 9 to 12, but can be modified for students in Grades 5 to 8.

Learning outcomes

- Probabilities
- Problem solving
- Critical thinking

Required materials

1. Coloured dice: one dice per student.

2. Candy: 6 candy per student (you can change the initial number of candies, but ensure all students get the same number of candies for the hands on activities).
3. Paper and pencil for the students to do scrap work.
4. Board and marker to go over math behind the game.

Preparation

1. Divide the class into pairs. Each pair will get two dice of different colours, one for each person.

2. Have the students in the pair choose their die – they will need to take note of the outcome they get when they roll.

3. Ask each pair to decide who will play “player 1” and who will play “player 2”.

4. Explain the rules of the game:
    a. Both players roll the dice.
    b. If Player 1’s outcome is greater than or equal to player 2’s outcome (that is if Player 1’s outcome is larger or if there is a tie), then Player 1 takes one point (usually represented by candy, toothpicks, or other object) from player 2.
    c. Otherwise Player 2 takes one point from player 1.

During the activity:

1. Once the students have divided into pairs and chosen their roles, have them play 10 rounds.

2. After the 10 rounds are completed, ask them if they think the game is fair and why.
    a. Suggestion 1: what happens when there is a tie?
    b. Suggestion 2: who tends to win more often?

3. Ask player 1 students to raise their hands if at the end of the 10 rounds, they have the highest number of points. Do the same for player 2 students. Compare the number of player 1 students who won against the number of player students who won.

4. Repeat the game, but this time have Player 2 take two points from Player 1 instead of one. The rest of the rules stay the same.

5. Ask the students to share whether they think the game is fair and why.

a. Suggestion: why does the number of points Player 2 get not change the fairness of the game?

6. Ask player 1 students to raise their hands if at the end of the 10 rounds, if they have the highest number of points. Do the same for player 2 students. Compare the number of player 1 students who won against the number of player 2 students who won.

Discussion

At the end of the activity, items which can be discussed with the students can be modified depending the topic you're teaching and can include:

1. Sample space associated to the probability game
2. Expected per-round payoff for each player
3. Theoretical vs experimental probability

Take the unfair dice problem online

Click here to view the Callysto lesson plan for the online version of this activity.