

Activity: Evo "21" Game

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Introduction

The game known as "21" exists in a variety of forms for both cards and dice. Now you can play "21" with Evo! The included OzoMap, a small copy of which is shown in Figure 1, is your game board. Evo *doubles* as your game piece *and* pair of dice. The game also encourages students to think carefully about probability and the risks associated with decisions. To this end five student exercises relating to probabilities in the game of "21" are included.

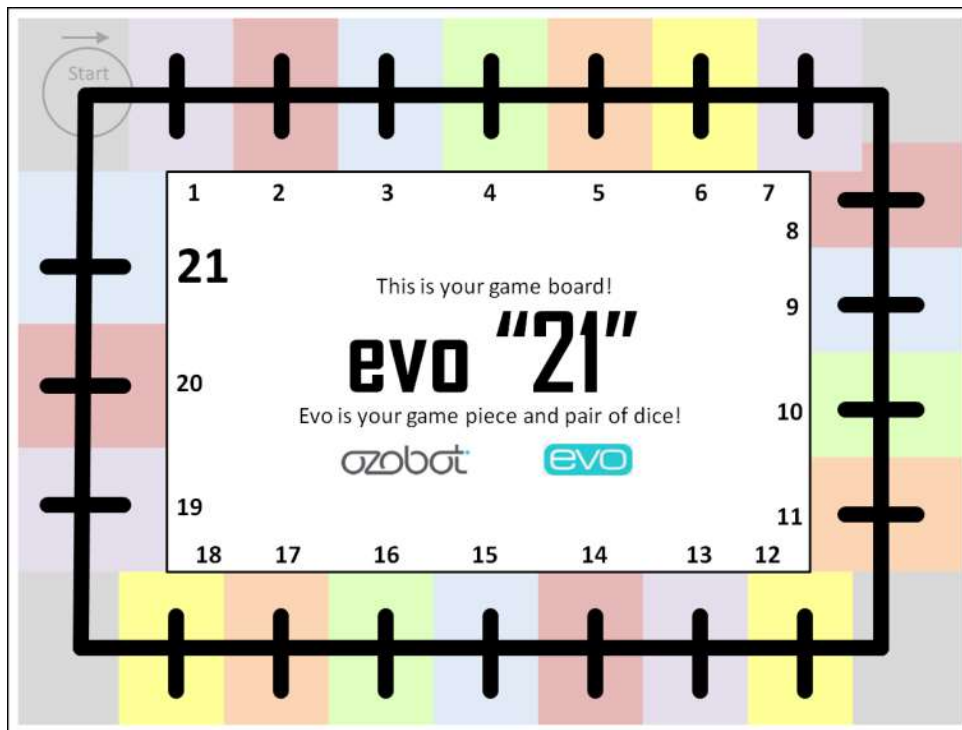


Figure 1

Here is how Evo "21" works. The game is simple and fast-paced. The goal of each player is to score 21, or as near as possible to it without going over 21, by throwing a pair of ordinary six-sided dice as many times as desired and adding up the numbers thrown. A player can elect to stop throwing the dice at any time and *hold* his or her score as it currently is. Any player who throws over 21 is said to *bust* and is out of the game. Any remaining player having the highest total without exceeding 21 is the winner. A playoff is held in the event of a tie between two or more players.

Instructions for Playing Evo “21”

1. Load Evo with the OzoBlockly program *Evo21Game.ozocode*.
2. To run the program on Evo, begin with Evo powered down. Press Evo’s button once to turn Evo on. Then when the front lights show blue, double-press the button. Evo’s top light should then be white. The OzoBlockly program has started running.
3. You now have 12 seconds to select the color of Evo, which is your game piece. Each press of the button during this 12-second interval will change the color of Evo’s top light in the sequence white, red, green, blue, and yellow. Simply stop pressing the button when you have your desired game piece color.
4. Place Evo on the Start location of the Game Board facing the direction shown by the arrow. (A full-size Game Board, suitable for working with Evo, accompanies this lesson.)
5. After the 12 seconds have elapsed, Evo will voice announce the random result of rolling a pair of ordinary six-sided dice. This will be a number between 2 and 12, inclusive, since the sum of the faces up on a pair of dice is always in that range.
6. Evo will then move that number of spaces on the game board, stopping momentarily and beeping with each space moved.
7. After moving the number of spaces he announced, Evo will flash his front lights in a multicolored disco animation for about a second. The player then has 3 seconds to decide whether to continue or hold. To continue, the player doesn’t need to do anything, as Evo will announce the result of the next roll of the dice and will start moving. To hold, the player must press Evo’s button during the three-second interval. Evo will then announce the player’s total score and then turn off.
8. In the event of a player bust (exceeding 21 points), Evo will announce your bust total, quickly flash red several times, and then turn off .
9. In the event of a perfect score of 21, Evo will flash his front lights in a police car animation, make a full circle spin, and then announce “21” three times.

Probability and Risk

First, discuss with the class the probabilities for obtaining each of the sums for rolling a pair of dice. You can use Figure 2 as an aid in this discussion. For example a sum of 4 can be obtained in 3 different ways: rolling a 4 and 1, a 1 and 4, or rolling 2 and 2. The total number of ways to roll a pair of dice then turns out to be 36, each of these 36 being equally probable, with probability of 1 in 36, or $1/36$. Rolling a sum of 7 has the highest probability $6/36$ or 1 in 6 chances. Rolling sums of 2 or 12 are least probable, with a 1 in 36 chance, or a probability of $1/36$.

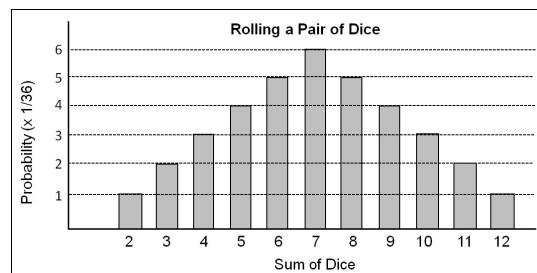


Figure 2

Evo 21 Exercises

1. Suppose that you have just landed at position 19 on the Evo board.
 - What is the probability that you will get 21 on the next roll of the dice?
 - What is the probability that you will bust on the next roll of the dice?
2. Suppose that you have just landed at position 20 on the Evo board.
 - What is the probability that you will get 21 on the next roll of the dice?
 - What is the only sensible strategy for you at this point?
3. Suppose that you have just landed a position 17 on the Evo board.
 - In the event that you decide to roll again, what is the probability that you will still be in the game after your next roll?
 - In the event that you decide to roll again, what is the probability that you get 21 on your next roll?
4. You and a good friend of yours are playing Evo 21. You have just finished your turn, deciding to hold at 19. Your friend has just landed at position 14.
 - Assuming that your friend elects to continue playing and not hold, what is the probability that he and you are tied after his next roll?
 - Assuming that your friend elects to continue playing and not hold, what is the probability that he/she busts on the next roll?
 - Assuming that your friend elects to continue playing and not hold, what is the probability that he/she lands on 21 on the next roll?
5. Here is a more challenging problem. What is the probability of getting 21 in exactly two rolls of the pair of dice?