

“Struck by Lightning” Supplementary Materials

Group Exercise about Conditional Probabilities

Working cooperatively with your group, consider the following questions.

Small groups exercise about the “Three-Card Thriller”:

Suppose there are three cards: one Blue on both sides, one Yellow on both sides, and one Blue on one side and Yellow on the other. Suppose one card is selected (uniformly at random), and one side of that card is shown (uniformly at random).

1. Before looking at anything at all, what is the probability that the Yellow-Yellow card was selected?
 2. Suppose the side of the card which is showing is Yellow. Now what is the probability that the Yellow-Yellow card was selected?
 3. Suppose the side of the card which is showing is Blue. Now what is the probability that the Blue-Blue card was selected?
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Small groups exercise about the “Monty Hall Problem”:

In the Monty Hall Problem, there are three cards (representing three doors), one of which is Black (representing a car behind the door) and two of which are Red (each representing a goat behind the door). The player selects one card. The host then shows one of the OTHER cards, which is Red. The player then has the option to stay with their original selection, or switch to the remaining card. Using discussion, roll playing, and experimentation, try to determine the probability that the player will end up with the Black card (i.e., the car) if they stay versus if they switch, under each of the following assumptions:

1. The host holds the cards (so the host can see them, but the player cannot). After the player selects, then the host picks one of the other cards, being careful to pick a card which is Red. In the case where host has two different Red cards available to pick (i.e., if the player happened to select the Black card in the first place), then the host picks either of the two available Red cards with equal probability. The player then has the option to stay or switch, as above.

If you have time, consider the following variations:

2. The host holds the cards. After the player selects, then the host picks one of the other cards, being careful to pick a card which is Red. In the case where the host has two different cards available to pick (i.e., if the player happened to select the Black card in the first place), then the host always picks whichever of the two available cards is to their LEFT. (Assume the player knows that the host will do this, and that the player can SEE which of the available cards the host picks.) The player then has the option to stay or switch, as above. Consider two different cases:

- (a) The player sees the host pick the RIGHT-most available card.
- (b) The player sees the host pick the LEFT-most available card.

3. The cards are dealt face down. After the player selects, then the host simply picks one of the other cards at random. If that card happens to be Black, then the experiment is nullified and begins again. Otherwise, if that card happens to be Red, then the game proceeds as above, i.e. the player then has the option to stay or switch at that point.