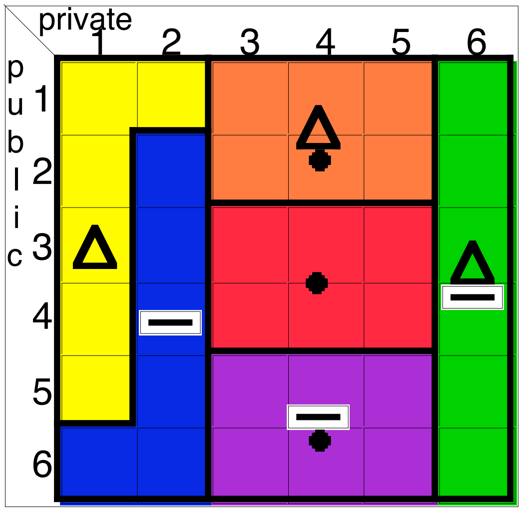
SPY GAME

Original game design by Prof. Neil Cotter
Some rules modified by Prof. Tolga Tasdizen



Symbols for colors

Yellow: triangle
Blue: bar
Orange: triangle and dot
Red: dot
Purple: bar and dot
Green: triangle and bar

Object: Determine as many opponent's color as you can.

Start: All players pick one glass token unseen. All players take one dice.

Play: When it is your turn, roll your dice once in public (make sure everyone sees this) and once in private (make sure nobody sees this). Use the color chart to announce an outcome. Announce **HIT** if the public, private dice pair landed on your color. Otherwise, announce **MISS**. Go around the table 5 times (so everybody gets to roll 5 times).

Hint: It will be to your advantage to record each player's public dice roll and their announcement to consult in the next stage of the game.

Identify: After the 5 rounds are completed, every player will make a list of the identification he wants to make. On a piece of paper, write down the players you are identifying and the colors you think they have. Note, you don't have to identify every single player. In fact, it is to your advantage to identify only those players you are fairly certain of their color.

Win: Everyone reveals their color and their identification sheet. For each correct identification you get +1 point. For each wrong identification you get -1 points. The player with the highest sum wins.

Intuitive analysis of spy game

Question 1: Lets assume someone just rolled a 6 in public and announced *HIT*. Based on this information what is the conditional probability that his color is *blue*?

Solution: Since they rolled a 6 in public this limits us to row 6 of the game board. There are 6 squares in that row. Since the private dice is independent of the public dice, each square in row 6 will have probability 1/6. Since the player announced *HIT* he must be *blue, purple* or *green*. 2 of the 6 squares on row 6 are blue so the conditional probability that this player is *blue* is 2/6. Also notice that the conditional probability that they are *purple* is 3/6 and the conditional probability that they are *green* is 1/6. Finally, we can be sure they are not *yellow, red* or *orange* because those colors don't have any squares on the sixth row and couldn't have announced a HIT. Therefore, the conditional probabilities for those colors is now 0.

Question 2: You are the *purple* player. Lets assume someone just rolled a 6 in public and announced *HIT*. Based on this information what is the conditional probability that his color is *blue*?

Solution: Since they rolled a 6 in public this limits us to row 6 of the game board. There are 6 squares in that row, but we columns 3,4 and 5 are out of the space of possible outcomes. Why? Because if the result of the private dice roll was 3, 4 or 5 the player would have had to announce *MISS* since he can't be *purple* (you are purple). Therefore, there are now only 3 possible outcomes to consider (private dice=1,2 or 6). Of these 3 outcomes, 2 correspond to the blue color. Therefore, the conditional probability that this player is *blue* is 2/3. Much more improved odds! The conditional probability that they are *green* is 1/3. Finally, we can still be sure they are not *yellow, red* or *orange* because those colors don't have any squares on the sixth row and couldn't have announced a HIT. Therefore, the conditional probabilities for those colors is now 0.