

### 1. Rock, Paper, Scissors

- (a) Play 30 rounds of rock/paper/scissors with a partner. Each of you should record your sequence of strategies and the number of points (1 for a win, 0 for a tie and -1 for a loss). See who gets the most points.
  
- (b) The correct mixed strategy is to play rock, paper and scissors each with probability  $1/3$ . Use a  $\chi^2$  to test whether or not the frequency that you played rock, paper and scissors is consistent with this strategy.
  
- (c) Now play 30 rounds of rock/paper/scissors with golden scissors. If your scissors are beaten you lose 2 points and your opponent wins 2. Rock and paper are still worth 1 point. Each of you should record your sequence of strategies and the number of points you win or lose. See who gets the most points.
  
- (d) Make sure you complete your game before reading on. The correct mixed strategy for this game is to play rock  $1/4$  of the time, paper  $1/2$  the time, and scissors  $1/4$  of the time. Use a  $\chi^2$  to test whether or not the frequency that you played rock, paper and scissors is consistent with this strategy.

### 2. Quaak

Quaak is an interesting strategic game involving mixed strategies that change as the game progresses. In this game, each player starts with 15 chips. In each round the players secretly removes 3,2,1, or 0 chips from their pile and bets them against the other player. Whoever bets the most wins the round. The play is repeated until both players have used up all their chips, or when one player has won three more rounds than the other. Find a partner and play this game a three or four times times. Record the bets each of you makes. Test the hypothesis that players in this game randomly choose between the four betting options.

You may also wanted to try this game against a computer opponent – who is able to calculate the right mixed strategy at each round.

[http://www.bewersdorff-online.de/quaak/quaak\\_e.htm](http://www.bewersdorff-online.de/quaak/quaak_e.htm)

3. Consider the following matrix game. Play it 40 times with a partner, with one as Rose and one as Colin for the entire game. Play to get as many points as possible. Record the outcome and the scores for each game.

		Colin	
		A	B
Rose	A	(-1,3)	(4,-1)
	B	(3,-4)	(-2,2)

Calculate the expected frequencies assuming that players play with the optimal mixed strategy, and use the  $\chi^2$  to see if there is evidence that you played optimally.