

3. In lecture we discussed how to lose money at American roulette. It turns out that in European roulette there is only one green 0, and so 18 out of 37 slots are red and 18 out of 37 slots are black. If you bet \$1 on black, you win \$1 if black shows up and lose \$1 if it doesn't.

A) [3 pts] Suppose you bet \$1 on black for each of 8 independent spins of a French roulette wheel. Explain why the number of bets you win can be modeled as a binomial random variable.

B) [3 pts] What is the probability that you win exactly 3 out of the 8 bets?

C) [5 pts] How much total money do you expect to win or lose over your 8 bets? Justify your answer.

D) [5 pts] We design an experiment to test whether a book's "system" for roulette is better than betting haphazardly on red or black. Briefly describe these terms in the context of our experiment.

Experimental (Factor) Variable:

Response Variable:

Control Group:

Random Assignment:

Repetition:

4. A 2010 study investigated cognitive-behavioral therapy in a sample of 109 children with obsessive-compulsive disorder (OCD). After treatment, they recorded the children's scores on the Yale-Brown Obsessive-Compulsive Scale (Y-BOCS) and whether the clinician believed the OCD to be in remission.

A) [8 pts] 73 of the 80 children in remission had a Y-BOCS score of 14 or below, while 26 of the 29 children judged not to be remission had higher scores. Suppose the researchers decide to use "Y-BOCS score of 14 or below" as a test to diagnose whether a child is in remission. From this sample, estimate the sensitivity, specificity, positive predictive value, and negative predictive value of this test. Round all estimates to the nearest percent.

Sensitivity: _____

Specificity: _____

PPV: _____

NPV: _____

Space to show work:

B) [2 pts] Suppose that the researchers instead decided to use "Y-BOCS score of 11 or below" to diagnose whether a child is in remission. How will this affect the sensitivity and specificity of the test? Circle the most likely outcome for both sensitivity and specificity.

Sensitivity will: increase decrease stay the same

Specificity will: increase decrease stay the same