

Class Exercise

1. Dragonfly Evasion

Female dragonflies fake sudden death to avoid unwanted male suitors.

To estimate how common this behaviour is in the wild, a researcher examines 180 randomly selected female dragonflies during the peak mating season and finds that 117 of them display death-feigning behaviour when approached by a male.

- Construct and interpret a 90% confidence interval for the true proportion of female dragonflies that use death-feigning behaviour to avoid unwanted mates.
- The researcher wants to estimate this true proportion with a 90% confidence level and a margin of error of no more than 4%. A preliminary field study suggests that about 68% of females use death-feigning as an avoidance strategy. What is the minimum sample size that should be used?
- Construct and interpret a 99% lower confidence bound for the true proportion of female dragonflies that engage in death-feigning to avoid male suitors.

2. Shady Deals

A recent court case in Canada dealt with a dispute between two businessmen over the profits from their shady dealings. The two businessmen had drawn up a contract which had a section called 'Shady Deals'.

Financial investigators reviewing the case believe that the actual average profit per shady deal is higher than the amount stated in the contract. From previous audits of similar cases, it is known that the population is approximately normal and the population standard deviation of profits per deal is \$15 thousand dollars.

To evaluate the claim, investigators collect records from 40 shady deals linked to the two businessmen. The sample shows an average profit of $\bar{x} = \$65.3$ thousand, whereas the contract lists the expected profit per deal as only \$60 thousand.

- At the 5% level of significance, is there sufficient evidence to support the claim that the true average profit per shady deal exceeds the contract's stated amount? Include a conclusion in the context of the problem and report the P -value.
- Construct and interpret an appropriate confidence bound for the true average profit per shady deal. Explain how this bound can be used to support the conclusion in part (a).

3. Elephant Pranks

Elephants have been known to play pranks on each other. Based on earlier, informal observations, it is claimed that an elephant in a playful herd plays an average of 8 pranks per week.

A skeptical ethologist believes this number is an overestimate and that the true average prank rate is actually less than 8 per week. To investigate, she records prank behaviour in a random sample of 36 elephants from several playful herds and finds that the mean number of pranks is $\bar{x} = 7.65$ per week. Assume the population is approximately normal and that the population standard deviation is known to be 1.8 pranks per week.

- (a) At the 3% level of significance, is there sufficient evidence to conclude that the average prank rate is less than 8 pranks per week? Report a p -value and draw a conclusion in the context of the problem.
- (b) Construct and interpret an appropriate confidence bound for the true average prank rate among elephants in these playful herds. Explain how this interval estimate can be used to support the conclusion obtained in part (a).