

HELICOPTER FLIGHTS

The Question

How does the mean time it takes for a helicopter to fall to the floor change as the height from which it is dropped increases?

Materials

- Helicopter Template
- Stopwatches
- Measuring tapes or meter sticks
- Paper clips (for varying weight) or medium-sized binder clips for outdoor drops
- Masking tape (to mark drop heights on vertical wall)
- Cards, dice, or random digit table

Experimental Design

Describe in detail how you will collect your data. Include the number of trials you will conduct at each height, the heights you will use, and how you will randomize these. Also address the issue of how the helicopters will be dropped (technique for dropping and who will do the drop) and how the descent will be timed (number of timers). Explain possible sources of variability in your data and efforts you will make to reduce effects of possible confounding variables. Describe the scope of inference for your results.

Data Collection

As your group collects data, record the drop height and time for each drop. You may use the attached Student Data Sheet or create a similar data sheet to be consistent with the design of your experiment.

STUDENT DATA SHEET

(Height is measured in meters, time in seconds)

Trial	Height: ____	Height: ____	Height: ____	Height: ____	Height: ____
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					

Descriptive Statistics

1. Construct a scatterplot of the response variable (time of descent) versus the explanatory variable (height) and copy it below. Does a linear model appear to be appropriate for these data? Explain.

2. Find a least squares regression line. Graph the line on the scatterplot and make a scatter plot of the residuals. Do you feel that a linear model is appropriate? Explain using the residual plot. What does the slope tell you about the relationship between drop height and descent time? What is the meaning of the y-intercept?

Inferential Statistics

1. Checking the assumptions: For each drop height, construct a histogram to display the distribution of times of descent. Calculate and record the sample mean and standard deviation of these distributions. Are the assumptions of normality and equal variance across values of the explanatory variable valid with these data? Explain. Also discuss any other assumptions necessary for inference on regression. Be sure to explain why you think each assumption is or is not satisfied.

2. Provide a copy of your computer output. Specifically include the parameter estimates and the standard errors of the estimates.

3. Perform a hypothesis test for the slope of the regression line. Be sure to state your hypotheses in both symbols and words.

4. Construct a confidence interval estimate of the slope β . Show all work.

5. Conclusions. State your conclusions in complete sentences, summarizing the results of the hypothesis test and confidence interval in the context of the question you are trying to answer.