B.1 Activity 3 Worksheet

This worksheet accompanies the article found at http://www.amstat.org/publications/jse/v10n3/haller.html

Purpose:

This project is intended to illustrate the properties of the sampling distribution of a sample proportion.

Instructions:

Work in groups of three. Each group should have 30 plain HERSHEY'S KISSES, 30 almond HERSHEY'S KISSES, a 16-ounce plastic cup, a copy of the Data Collection Sheets, and a copy of the Activity Worksheet.

Examine one plain and one almond HERSHEY'S KISS. There are two possible outcomes when a KISS is tossed - landing on the base and landing on the side.

Estimate the proportion of the time that a KISS will land on its base when tossed:

estimate for a plain KISS = _____

estimate for an almond KISS = _____

The investigation is as follows:
One group member should put 10 plain KISSES into the cup; and:

- Gently shake the cup twice to help mix up the candies.
- Tip the cup so the bottom of the rim is approximately 1-2 inches from the table and spill the candies.
- Count the number of candies that land on their base.
- Return the candies to the cup and repeat until you have spilled the candies 5 times.

A second group member should help the spiller count the candies. The third group member should record the results on the Data Collection Sheets.

After one group member has spilled the cup 5 times, the assigned duties should rotate among group members. After each group member has completed spilling the 10 plain candies five times, the process is repeated for 20 and 30 plain candies in the cup. After the process is completed for the plain candies, repeat the process for the almond candies.

After each group member has spilled 10, 20, and 30 of the plain KISSES and the almond KISSES, the group should complete the Data Collection Sheets. After the Data Collection Sheets are completed, begin work on Questions 1 through 4 on the following pages. We will discuss, as a class, how to complete Question 5.

Questions

1. Use the following table to summarize the **proportion** of base landings for tossing the plain HERSHEY'S KISSES. Record the proportions as decimals with two significant digits. (Use the data from Data Table 2 and Data Table 4 on the Data Collection Sheets.)

Table 1. *Proportion* of base landings for the plain HERSHEY'S KISSES.

Toss	$n = 10$	$n = 20$	$n = 30$	$n = 60$	$n = 90$
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

2. Answer the following questions using the data in Table 1.

(a) Calculate the standard deviation and the mean for the sample proportions from each column in Table 1. Write sentences to interpret the standard deviation for the sample proportions for each sample size.

(b) For which sample size is the standard deviation the largest and for which sample size is the standard deviation the smallest? Why do you suppose this happens?

(c) Calculate the ratio of the variance for the samples of size $n = 10$ divided by the variance for the samples of size $n = 20$. What whole number is this ratio closest to? Repeat this calculation for a comparison of $n = 10$ with $n = 30$. What whole number is this ratio the closest to?

(d) Using complete sentences, explain what happens to the variance of a sample proportion as the sample size is doubled. What happens to the variance as the sample size is tripled?

3. Use the following table to summarize the **proportion** of base landings for tossing the almond HERSHEY'S KISSES. Record the proportions as decimals with two significant digits. (Use the data from Data Table 2 and Data Table 4 on the Data Collection Sheets.)

Table 2. *Proportion* of base landings for the almond HERSHEY'S KISSES.

Toss	$n = 10$	$n = 20$	$n = 30$	$n = 60$	$n = 90$
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

4. Answer the following questions using the data in Table 2.

(a) Calculate the standard deviation and the mean for the sample proportions from each column in Table 2. Write sentences to interpret the standard deviation for the sample proportions for each sample size.

(b) For which sample size is the standard deviation the largest and for which sample size is the standard deviation the smallest? Why do you suppose this happens?

(c) Calculate the ratio of the variance for the samples of size $n = 10$ divided by the variance for the samples of size $n = 20$. What whole number is this ratio closest to?

Repeat this calculation for a comparison of $n = 10$ with $n = 30$. What whole number is this ratio the closest to?

(d) Using complete sentences, explain what happens to the variance of a sample proportion as the sample size is doubled. What happens to the variance as the sample size is tripled?

5. Use simulation to obtain the values of sample proportions of base landings for fifteen different samples of sizes $n = 5$, 15, 40, 80 and 120, where the true proportion of base landings is assumed to be $p = .30$. Record the proportions as decimals with two significant digits. We will do this together in class using a computer software package.

Table 3. Simulated proportions of base landings for HERSHEY'S KISSES.

Repetition	$n = 5$	$n = 15$	$n = 40$	$n = 80$	$n = 120$
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					