Chapter 10
Notes for Instructors

Content

Probability is the focus of this chapter. Students should be able to:

1. Understand and be able to explain the Law of Large Numbers.
2. Understand the difference between empirical probability and theoretical probability.
3. Calculate empirical and theoretical probabilities.
4. Understand the following terms.
   (a) mutually exclusive events
   (b) independent events
5. Apply the Addition Principle of Counting.
6. Apply the Multiplication Principle of Counting.
7. Evaluate permutations by applying the Multiplication Principle of Counting.
8. Use permutations and the Multiplication Principle of Counting to evaluate combinations.
9. Calculate odds.
10. Use geometry to calculate theoretical probabilities involving spinners and dart boards.
11. Construct experiments to simulate a real world situation.
12. Make a probability tree

You will probably need about two weeks for this chapter. Certainly, it would be easy to spend a lot of time on this chapter, but I feel that it is unnecessarily heavy on the notation. I think the emphasis should be on the students' ability to count, not their ability to decide whether to use the combination formula or the permutation formula, since these formulas easily fall from the Multiplication Counting Principle. I think you can teach this chapter without ever using the words "permutation" and "combination." Looking ahead, you really need to leave a lot of time for Chapters 11 and 12. In my experience, students have a lot of difficulty with the definitions in geometry and the unit concept in the measurement chapter.

Manipulatives and Technology

There are a lot of manipulatives that can be used in this chapter including dice, spinners, and playing cards. I don't think we have any of these in the Mathskellar, but some of the wooden blocks have been labeled as dice. You could label more if you need to do so. I

would suggest labeling them with two different colors, red and green, so that their sample space matches the sample space in the book. Also, there are several problems which involve drawing marbles out of a bag. This experiment can be mimicked with colored multi-link cubes and a hat or bag.

There are also several simulations in Winstats that could be helpful. The roll dice, the sample candy simulations will allow you to conduct some experiments without having dice and M&M's rolling around the room. (I will say that actual M&M's are very popular.) You also might find the spinner simulation and the dart-board simulation useful. In the spinner simulation you can change the size of the sectors on the spinners by selecting `Parameters...` under the `Edit` menu. Similarly, you can change the size of the circle and the square in the dart-board.

Notes and Suggestions:

Notes on Section 10.1: *Empirical Probability*

- Students should get a feel for the Law of Large Numbers by conducting an experiment repeatedly and seeing the empirical probability change as the number of trials increases.
- I used the M&M's®experiment to illustrate the Law of Large Numbers. I don't think it is possible to do the whole experiment in one class, but students should get the idea even if there isn't time for each student to do the experiments 25 times. You could make them do the experiments outside of class. Then you would only need to combine the data for the entire class and calculate the empirical probabilities during class. I think this would work well. You can find the actual color distribution for M&M's®at

  `http://www.mmmars.com/cai/mms/faq.html#what_colors`

- I really like question 7, 14, 15, and 17–19 in Section 10.1.

Notes on Section 10.2: *Principles of Counting*

- You might want to quickly review the Multiplication Tree Model for multiplication in Section 2.4 (p.115). This model combined with probability trees provides some justification for the Multiplication Principle of Counting.
- I think it is best to solve all of the problems in this section using only the Addition and Multiplication Principles of Counting. Permutations and combinations should flow naturally from the Multiplication Principle. (See the discussion on page 621.) I found that too many students were relying too heavily on the formulas for permutations and combinations.

Notes on Section 10.3: *Theoretical Probability*

- The only new concepts here are odds and expected value, if you choose to cover them.

- On problem 10 in Section 10.3, your students will need to assume that the mark will indicate both a number and a letter. Therefore, the probability that the mark is on the shaded area is $\frac{3}{10}$. If this is not the case, then we need to specify the radii of the circles.

Worksheets

I have included one worksheet with this documentation.