

Chapter 2.3 Multiplication Counting Rule

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Chapter 2 Counting Methods

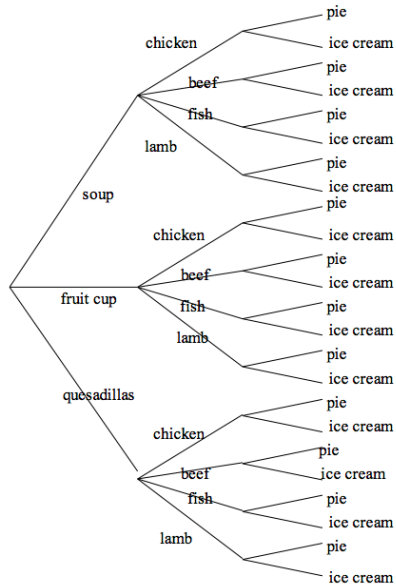
Introduction

- ▶ To apply the equally likely recipe for computing probabilities, one needs some methods for counting the number of outcomes in the sample space and the number of outcomes in the event.
- ▶ Here we illustrate a basic counting rule called the multiplication rule.

Dining at a restaurant

- ▶ Suppose you are dining at your favorite restaurant.
- ▶ Your dinner consists of an appetizer, an entr'ee, and a dessert.
- ▶ You can either choose soup, fruit cup, or quesadillas for your appetizer, you have the choice of chicken, beef, fish, or lamb for your entr'ee, and you can have either pie or ice cream for your dessert.
- ▶ Use a tree diagram to write down all of your possible dinners.

Tree diagram



Counting the number of complete dinners

- ▶ Note that there are 3 possible appetizers, 4 possible entr'ees, and 2 possible desserts.
- ▶ For each appetizer, there are 4 possible entr'ees, and so there are $3 \times 4 = 12$ possible choices of appetizer and entr'ee.
- ▶ For each combination of appetizer and entr'ee, there are 2 possible desserts, and so the total number of complete dinners would be

$$\text{Number of dinners} = 3 \times 4 \times 2 = 24.$$

Multiplication rule

- ▶ Suppose one is performing a task that consists of k steps. One performs the first step in n_1 ways, the second step in n_2 ways, the third step in n_3 ways, and so on.
- ▶ Then the number of ways of completing the task, denoted by n , is the product of the different ways of doing the k steps, or

$$n = n_1 \times n_2 \times \dots \times n_k.$$