**Activity 7.2.3. Estimating Probabilities from Survey Data**

Turn on the news, open a newspaper, or search the Internet and you will find many instances in which results of a survey are reported. For many large surveys, the participants were selected in such a way that they are representative of the larger population from which they were chosen. In these cases, the relative frequencies of their responses can be used to estimate probabilities.

1. Each year the study *Monitoring the Future: A Continuing Study of American Youth* surveys students on a wide range of topics, including family background. One of the questions on the survey is given below along with the possible responses.

Did your mother have a paid job (half-time or more) during the time you were growing up?

No Yes, some of the time when I was growing up

Yes, most of the time Yes, all or nearly all of the time

The survey was administered to a large sample of 12th grade students. Care was taken to ensure the sample was representative of all 12th grade students. Results appear in Table 1.

|  |  |  |
| --- | --- | --- |
| Response | Frequency of responses | Probability  (estimate) |
| No | 1860 |  |
| Yes/Some | 2634 |  |
| Yes/Most | 2392 |  |
| Yes/Nearly All | 6864 |  |
| Total |  |  |

Table 1. Results from survey question on mother’s job.

a. How many students answered this question?

b. Calculate the relative frequency of each response. (Round to three decimal places.) Use the relative frequencies as estimates of the probabilities and enter them into Table 1.

c. What is the sum of the probabilities?

d. A randomly selected 12th grade student is asked to answer this question. What is the probability that the student will give a response different from No? Explain how you determined your answer.

2. The Current Population Survey (CPS) is a major source for labor force data for the population of the United States. Table 2 provides the frequency of responses to a CPS question on household income.

|  |  |  |
| --- | --- | --- |
| Total Household Income | Frequency | Probability  (estimated from relative frequency) |
| Under $25,000 | 35,259 |  |
| $25,000 to $49,999 | 44,243 |  |
| $50,000 to $74,999 | 37,381 |  |
| $75,000 to $99,999 | 28,312 |  |
| $100,000 or over | 57,439 |  |
| Total |  |  |

Table 2. Total household income

(from 2015 Annual Social and Economic Supplement, Current Population Survey).

a. How many people responded to the survey?

b. Calculate the relative frequencies for each of the possible responses. (Round relative frequencies to four decimal places.) Use the relative frequencies to complete the last column of Table 2.

c. What is the probability that a randomly chosen household will have a total income less than $100,000?

d. What is the probability that a randomly chosen household will have a total income of at least $75,000?

e. What is the probability that a randomly selected household has a total income below $75,000?