Math 1313 Section 6.2

Section 6.2: Introduction to Probability

The ratio $\frac{m}{n}$ is the **relative frequency** of an event E that occurs m times after n repetitions.

Note: The probability of an event is a number that lies between 0 and 1, inclusive.

If S = $\{s_1, s_2, \ldots, s_n\}$ is a finite sample space with n outcomes, then the events $\{s_1\}, \{s_2\}, \ldots, \{s_n\}$ are called **simple events** of the experiment.

Once probabilities are assigned to each of these simple events, we obtain a probability distribution.

The probabilities, $P(s_1), P(s_2), \ldots, P(s_n)$ have the following properties:

1. $0 \le P(s_i) \le 1, \; i = \{1, 2, 3, \ldots, n\}$
2. $P(s_1) + P(s_2) + \cdots + P(s_n) = 1$
3. $P(s_i \cup s_j) = P(s_i) + P(s_j), \; i \ne j$ and $i, j = 1,2,3, \ldots n$

Example 1: A fair die is cast. List the simple events.

A sample space in which the outcomes of an experiment are equally likely to occur is called a uniform sample space. Let S = $\{s_1, s_2, \ldots, s_n\}$ be a uniform sample space. Then

$$P(s_1) = P(s_2) = \cdots = P(s_n) = \frac{1}{n}$$

Finding the probability of an Event E:

1. Determine the sample space S.
2. Assign probabilities to each of the simple events of S.
3. If E=$\{s_1, s_2, \ldots, s_k\}$ where $\{s_1\}, \{s_2\}, \ldots, \{s_k\}$ are simple events then

$$P(E) = P(s_1) + P(s_2) + \cdots + P(s_k)$$

Note: If E = Ø then P(E) = 0.

Example 2: The accompanying data were obtained from a survey of Americans who were asked: How safe are American-made consumer products

Rating	Number of Respondents
Very Safe	76
Somewhat safe	244
Not too safe	60
Not safe at all	8
Don't know	12

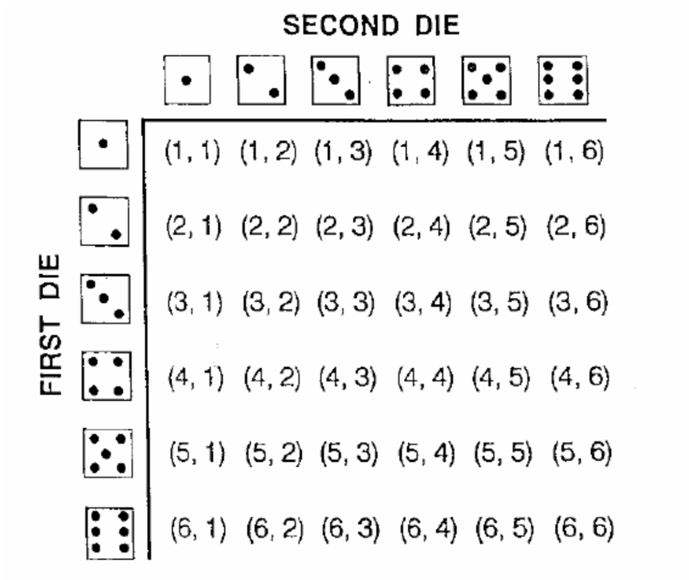
Find the probability distribution associated with this experiment.

Example 3: A pair of fair dice is cast. What is the probability that

a. the sum of the numbers shown is less than 5?

b. at least one 6 is cast?

c. you roll doubles?



Example 4: If one card is drawn from a well-shuffled standard 52-card deck, what is the probability that the card drawn is

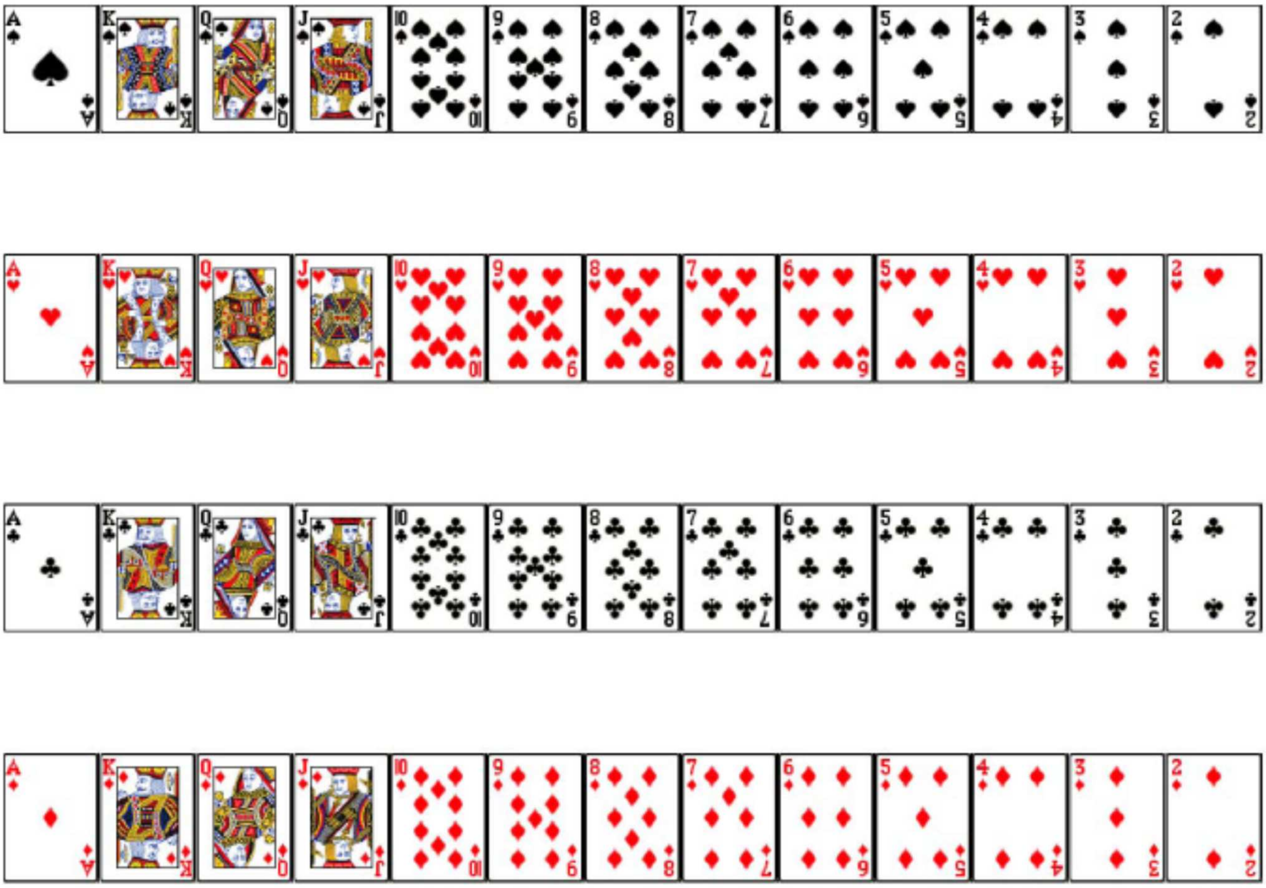
a. A club?

b. A red card?

c. A seven?

d. A face card?

e. A black 9?



Example 5: A survey was taken in a certain community about the number of the radios in the house, the probability distribution was constructed:

Number of Radios	0	1	2	3
Probability	0.01	0.09	0.53	0.37

What is the probability of a house chosen at random from this community having,
a. 1 or 2 radios?

b. more than 1 radio?

c. not even one radio?

Example 6: Let $S = \{s_1, s_2, s_3, s_4, s_5\}$ be the sample space associated with an experiment having the following probability distribution:

Outcome	s_1	s_2	s_3	s_4	s_5
Probability	$\frac{1}{10}$	$\frac{1}{5}$	$\frac{1}{20}$	$\frac{2}{5}$	$\frac{1}{4}$

If $G = \{s_2, s_5\}$, $H = \{s_1, s_2, s_3\}$, and $I = \{s_1, s_4\}$. Find the probability.

a. $P(G)$

b. $P(G \cup H)$

c. $P(I \cap G)$