Math 120 8.1 Sample Spaces, Events & Probability

Experiment: Any process or study which results in the collection of data, the outcome of which is unknown: rolling a die, flipping a coin, gender of a child

Event: The outcome of an experiment: rolling a 2, getting a heads, having a girl

Sample Space (S): the set of all possible outcomes of an experiment

Probability of an Event P(E): The likelihood that an event will occur.

$$P(E) = \frac{n(E)}{n(S)} = \frac{\text{the number of elements in } E}{\text{the number of elements in } S}$$

Certain Event: P(E) = 1   Impossible Event: P(E) = 0   Note: $0 \leq P(E) \leq 1$

Examples For each problem, write the sample space and then determine the probabilities.

1. Experiment: Rolling 1 die. Find the probability of the following events:
   a) rolling a 2 = $\frac{1}{6}$ $S = \{1, 2, 3, 4, 5, 6\}$

   b) rolling an even number = $\frac{3}{6} = \frac{1}{2}$

   c) rolling a 7 = $\frac{0}{6} = 0$

   d) rolling a number that is divisible by 3 = $\frac{2}{6} = \frac{1}{3}$

   e) rolling a number less than 7 = $\frac{6}{6} = 1$

2. Experiment: Flipping 2 coins. Find the probability of the events:
   a) getting exactly one head $\{HH, HT, TH, TT\}$
      $\frac{2}{4} = \frac{1}{2}$

   b) getting two heads = $\frac{1}{4}$

   c) getting at least one head = $\frac{3}{4}$

3. Experiment: Rolling two dice. Find the probability of getting:

a) sum of 7 $= \dfrac{6}{36} = \dfrac{1}{6}$

b) sum of 11 $\dfrac{2}{36} = \dfrac{1}{18}$

c) sum less than 5 $= \dfrac{6}{36} = \dfrac{1}{6}$

d) sum of 7 or 11 $= \dfrac{8}{36} = \dfrac{2}{9}$

e) a double $= \dfrac{6}{36} = \dfrac{1}{6}$

f) sum greater than 5 $= \dfrac{26}{36} = \dfrac{13}{18}$

g) snake eyes $= \dfrac{1}{36}$

Sum	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

4. Experiment: Drawing 1 card from a deck of cards. Find the probability of drawing :

a) an 8 $= \dfrac{4}{52} = \dfrac{1}{13}$

b) a queen $= \dfrac{4}{52} = \dfrac{1}{13}$

c) a face card $= \dfrac{12}{52} = \dfrac{3}{13}$

d) a spade (or) an ace $\rightarrow \dfrac{13+3}{52} = \dfrac{16}{52} = \dfrac{4}{13}$

e) a spade (and) an ace $= \dfrac{1}{52}$

f) a red and a spade $= \dfrac{0}{52} = 0$

5. A box of 20 gumdrops was found to contain the number of gumdrops listed in the table. Assume that each gumdrop has an equal chance of being selected. If one gumdrop is drawn from the box, what is the probability of drawing

Lemon	Orange	Cherry	Grape	Total
6	8	3	3	20

a) an orange gumdrop $= \dfrac{8}{20} = \dfrac{2}{5}$

b) a cherry gumdrop $= \dfrac{3}{20}$

c) a lemon or orange gumdrop $= \dfrac{6+8}{20} = \dfrac{14}{20} = \dfrac{7}{10}$

6. In a family with two children,

find the probability of having: $2^2 = 4$

a) exactly one girl $= \dfrac{2}{4} = \dfrac{1}{2}$

b) two girls $= \dfrac{1}{4}$

c) at least one girl $= \dfrac{3}{4}$

d) two boys $= \dfrac{1}{4}$

G G
G B
B G
B B

7. In a family of 3 children,

$$2^n = 2^3 = 8$$

find the probability of having:

a) one girl $= \dfrac{3}{8}$

b) two girls $= \dfrac{3}{8}$

c) 3 girls $= \dfrac{1}{8}$

d) having at least one girl $= \dfrac{7}{8}$

G G G
G G B
G B G
G B B
B G G
B G B
B B G
B B B