Section 12.3 Probability

The sample space, S, of an experiment consists of all of the possible outcomes of that experiment.

For example, rolling a 6-sided die would have $S = \{1, 2, 3, 4, 5, 6\}$ An event E is a subset of S.

For example if E is rolling an even number then $E = \{2, 4, 6\}$.

The probability of E, $p(E) = \frac{n(E)}{n(S)} = \frac{\#\text{ of ways } E \text{ happens}}{\#\text{ in sample space}}$

$$p(E) = \frac{3}{6} = \frac{1}{2}$$

ex 5 p922

$$p(\text{2 boys, 1 girl}) = \frac{3}{8}$$

$$S = \{BBB, GGG, \underline{BBG}, \underline{BGB}, \underline{GBB}, GGB, GBG, BGG\}$$

ex 6 p922

E = "roll an odd number" $E = \{1, 3, 5\}$

F = "roll a 1 or 2" $F = \{1, 2\}$

$S = \{1, 2, 3, 4, 5, 6\}$

a) $E \cap F = \{1\}$

b) $E \cup F = \{1, 2, 3, 5\}$

c) $P(E) = \frac{3}{6} = \frac{1}{2}$ $p(F) = \frac{2}{6} = \frac{1}{3}$

d) $p(E \cap F) = \frac{1}{6}$

e) $p(E \cup F) = \frac{4}{6} = \frac{2}{3}$

$$p(E \cup F) = p(E) + p(F) - p(E \cap F)$$

ex: $p(E) = 0.2 \quad p(F) = 0.3 \quad p(E \cap F) = 0.1$

find $p(E \cup F)$

$$p(E \cup F) = 0.2 + 0.3 - 0.1 = 0.4$$

If E and F are mutually exclusive, $E \cap F = \emptyset$

$$p(E \cup F) = p(E) + p(F)$$

In our die example, $E = \{2,4,6\}$ so $\overline{E} = \{1,3,5\}$

$$p(E) + p(\overline{E}) = 1$$

$$p(\overline{E}) = 1 - p(E)$$

ex 9 p925 $\quad p(\text{rain}) = 0.4$

$$p(\text{no rain}) = 1 - p(\text{rain}) = 1 - 0.4 = 0.6$$

$$p(\text{at least 2 have same birthday}) = 1 - p(\text{none have same bday})$$

$$= 1 - \frac{{}_{365}P_{29}}{365^{29}} = 0.68$$

$${}_{365}P_{29} \quad \underbrace{\frac{365}{365} \cdot \frac{364}{365} \cdot \frac{363}{365} \cdots}_{365^{29}}$$

2/23 12/7 7/29 5/17 10/17 10/12

6/7 5/7 11/18 3/16 12/4 2/15

8/5 1/16 9/18 1/16 7/10

1/4 6/26 6/28 6/10 6/13

6/28 5/11 8/12 7/30 8/9

1/9 6/14 9/23 5/24

p930-931 27-61 odd