3.4 Mutually Exclusive Events

mutually exclusive events

→ two or more events that cannot occur at the same time.

Probability of mutually exclusive events:

Ex: What is the probability of rolling a 7 or a pair on one roll of a pair of dice?

1st what is probability of getting 7?

1 6 4 3
2 5 5 2
3 4 6 1

so 6 favorable

In total = $6 \times 6 = 36$

$P(7) = \frac{6}{36} = \frac{1}{6}$

2nd what is the probability of rolling a pair?

1 1 4 4
2 2 5 5
3 3 6 6

so $P(\text{pair}) = \frac{6}{36} = \frac{1}{6}$

Now probability of 7 or a pair

# of favorable outcomes = 12
# of total outcomes = 36

$P(7 \text{ or pair}) = \frac{12}{36} = \frac{1}{3}$

Note: $\frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$

Recall, for mutually exclusive events A and B,

$$n(A \cup B) = n(A) + n(B)$$

Probability for mutually exclusive events A and B

$$P(A \cup B) = \frac{n(A \cup B)}{n(U)}$$

universal set

$$= \frac{n(A) + n(B)}{n(U)}$$

$$= \frac{n(A)}{n(U)} + \frac{n(B)}{n(U)}$$

$$\boxed{P(A \cup B) = P(A) + P(B)}$$

MUTUALLY EXCLUSIVE

Probability of non-mutually exclusive events

Recall that $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

So, the $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Ex: On a single roll of a pair of 6 sided dice, what is the probability of rolling a pair or a sum of 8?

Note: Not mutually exclusive since rolling 4 and 4 gives a pair and a sum of 8.

Solution: $P(\text{Pair or 8}) = P(\text{pair}) + P(8) - P(\text{both})$

$= \frac{6}{36} + \frac{5}{36} - \frac{1}{36}$

$= \frac{10}{36} = \frac{5}{18}$

Ex: (#13 p179) One card from a standard deck of 52

(a) What is prob of drawing an 8 or King?

This is mutually exclusive

$P(8 \text{ or } K) = P(8) + P(K)$

$= \frac{4}{52} + \frac{4}{52}$

$= \frac{8}{52}$

$P(8 \text{ or } K) = \frac{2}{13}$

(b) What is the prob of a red card or face card?

Note not mutually exclusive since there are 6 red face cards.

$P(R \text{ or } F) = P(R \cup F) = P(R) + P(F) - P(R \cap F)$

$= \frac{26}{52} + \frac{12}{52} - \frac{6}{52}$

$= \frac{32}{52}$

$= \frac{8}{13}$

$P(R) + P(F|R)$

P. 177 #5-14