VIII. Cont.

i. Cont.

eg When three children are born, find the probability of having exactly one boy.

S: Sample space = {bbb, bbg, bgb, bgg, gbb, gbg, ggb, ggg}

P(exactly one boy) = $\frac{\text{'bgg, gbg, ggb'}}{8}$

$= \boxed{\frac{3}{8}}$

eg When three children are born, find the probability of getting at least one girl.

S: Sample space = {bbb, bbg, bgb, bgg, gbb, gbg, ggb, ggg}

At least one : one or more — 1, 2, ... ↖ 3 max

P(at least one) = $\boxed{\frac{7}{8}}$

Eg A box is filled with several party favors. It contains 15 hats, 20 noisemakers, four finger traps, and three bags of confetti. One party favor is chosen from the box at random.

Let H = the event of getting a hat.
Let N = the event of getting a noisemaker.
Let F = the event of getting a finger trap.
Let C = the event of getting a bag of confetti.
a. Find P(H).
b. Find P(F).

c. Find P(C).

S: Sample space = 15 + 20 + 4 + 3 = 42

a. $P(H) = \frac{15}{42} \approx \boxed{0.36}$

b. $P(F) = \frac{4}{42} \approx \boxed{0.10}$

c. $P(C) = \frac{3}{42} \approx \boxed{0.07}$

eg *Use the following information to answer the next two exercises.* You see a game at a local fair. You have to throw a dart at a color wheel. Each section on the color wheel is equal in area.

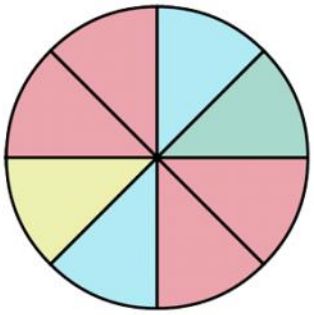


Figure 3.10

Let *B* = the event of landing on blue.
Let *R* = the event of landing on red.
Let *G* = the event of landing on green.
Let *Y* = the event of landing on yellow. ←

If you land on Y, you get the best prize, what is P(Y)?

S: Sample space = 8 slices

$P(Y) = \boxed{\frac{1}{8}}$

ii. Complement ← "the other half"

The complement of event A, denotes $\overline{A}$ with $P(\overline{A})$ =

The complement of event A, denotes $\bar{A}$, with $P(\bar{A})$ for probability. The $P(\bar{A})$ is the probability of event A that does not occur

$$\boxed{P(\bar{A}) = 1 - P(A)}$$

eg 1010 U.S. adults were surveyed and 202 of them were smokers.

S: Let A be a smoker

Then, $P(A) = \frac{202}{1010} = 0.2$ ← Prob. of smokers

Now, $P(\text{non-smokers}) = P(\bar{A})$

$= 1 - P(A)$

$= 1 - 0.2$

$= \boxed{0.8}$

eg When five children are born, find the probability of not getting the children of the same gender.

S: Sample space = {bbbbb, bbbbg, ... ggggb, ggggg}

↖ $2^{\text{five}} = 2^5 = 32$

Let S be the same gender, then

Let S be the same gender, then

$2^{five} = 2^5 = 32$

$$P(S) = \frac{\text{'bbbbb, ggggg'}}{32} = \frac{2}{32} = \frac{1}{16}$$

Now, $P(\bar{S}) = 1 - P(S)$

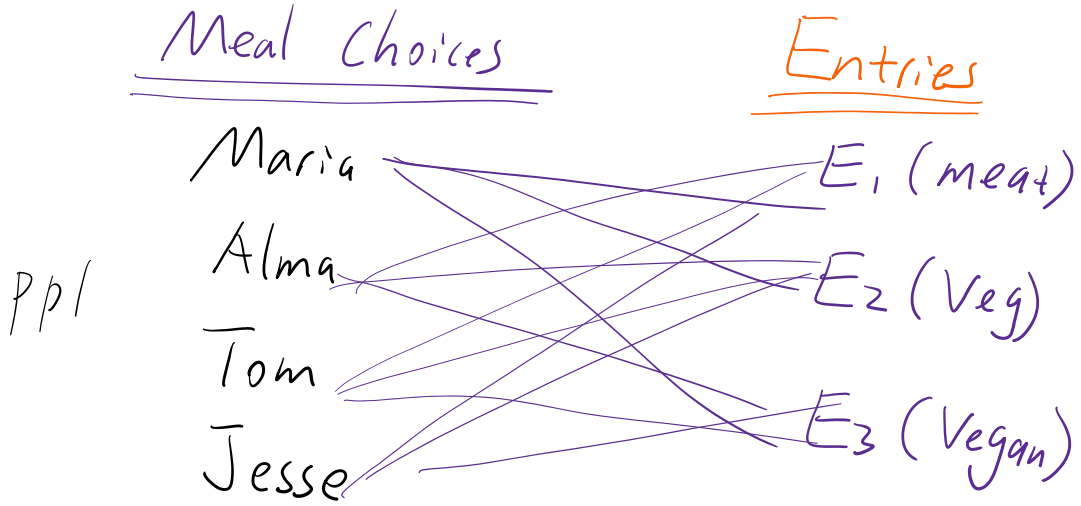
$$= 1 - \frac{1}{16}$$

$$= \boxed{\frac{15}{16}}$$

IX. Multiplication

The multiplication rule apply if event A and event B occur together, and they are independent. (If they are dependent, then it is a process.) ← later

eg Prob. Tree



$P(\text{dinner choice}) = \frac{1}{4} \cdot \frac{1}{3} = \frac{1}{12}$

Thus, we confirm that for event A and B:

$$\boxed{P(A \text{ and } B) = P(A) \cdot P(B)}$$, where A and B are independent.

Eg The probability of a person is being select for a job interview is 0.2. Then, the probability of acing the interview and would obtain the offer is 0.4. What is the probability of a person is successfully getting the job offer?

S:

Prob. of being select : 0.2

Prob of acing the interview : 0.4

$P(\text{job offer}) = P(\text{being select}) \cdot P(\text{acing the interview})$

$= 0.2 \cdot 0.4$

$= \boxed{0.08}$

Eg A marble is drawn from an urn that consists of 2 red marbles and 1 blue marble. After the first drawn, the marble is placed back into the urn. Then the a marble is drawn again. (this is said to drawn "with replacement")
Find the probability the first marble is red and the second is blue.

S:

Sample space = 2 + 1 = 3

Sample space = 2 + 1 = 3

$P(\text{red and blue}) = P(\text{red}) \cdot P(\text{blue})$

$= \frac{2}{3} \cdot \frac{1}{3}$ ← with replacement

$= \boxed{\frac{2}{9}}$

eg Redo the above example without replacement.

S:

$P(\text{red and blue}) = P(\text{red}) \cdot P(\text{blue})$

$= \frac{2}{3} \cdot \frac{1}{2}$ ← 1 has taken out

$= \boxed{\frac{1}{3}}$

eg There are 20 green balls and 15 black balls in a jar. What is the probability that the you draw a green ball first, then draw a black one next?

S:

Replacement or without? No.

Sample space = 20 + 15 = 35

$P(\text{green and black}) = P(\text{green}) \cdot P(\text{black})$

$= \frac{20}{35} \cdot \frac{15}{34}$ ← It doesn't say put it back so it is 1 ball less

$\approx \boxed{0.25}$

Eg In your drawer you have 10 pairs of socks, 6 of which are white, and 7 tee shirts, 3 of which are white. If you randomly reach in and pull out a pair of socks and a tee shirt. What is the probability that both are white?

S:

$$P(\text{white socks and white shirt})$$

$$= P(\text{white socks}) \cdot P(\text{white shirt})$$

$$= \frac{6}{10} \cdot \frac{3}{7}$$

$$\approx \boxed{0.26}$$

Eg What is the probability that two people born in the same day of the week?

S:

7 days a week

$$P(\text{1st day and 2nd day}) = P(\text{one day}) \cdot P(\text{one day})$$

$$= \frac{1}{7} \cdot \frac{1}{7}$$

$$= \boxed{\frac{1}{49}} \text{ or } \approx \boxed{0.02}$$

Eg What is the probability for two people born in the same day of the year (birthday)?

S:

$$P(\text{two same birthday}) = \frac{1}{365} \cdot \frac{1}{365}$$

$$\approx \boxed{0} \text{ or } \boxed{0.000008}$$

≈ 0 or ≈ 0.000008

Eg Compute the probability of drawing a King from a deck of cards and then drawing a Queen after.

S:

Example set of 52 poker playing cards

Suit	Ace	2	3	4	5	6	7	8	9	10	Jack	Queen	King
Clubs													
Diamonds													
Hearts													
Spades													

S: $P(K \text{ and } Q) = \frac{4}{52} \cdot \frac{4}{51}$ ← 1 has taken out

≈ 0.006

Eg Compute the probability of drawing two Ace from a deck of cards.

S: $P(A \text{ and } A) = \frac{4}{52} \cdot \frac{3}{51}$

≈ 0.005

Contingency Table

	Guards	Forwards	Centers	Total
Varsity Team	3	5	2	10
Jr. Varsity Team	6	8	1	15
Total	9	13	3	25

The **intersection** of **Varsity Team** **row** **AND** **the Guards** **column** **contains a** 3

There are 3 players who are both a **Varsity player AND a Guard**

The **intersection** of the **Varsity Team** **row** **AND** **the Forward** **column** **contains a** 5

There are 5 players who are both a **Varsity player AND a Forward**

The **intersection** of the **Varsity Team** **row** **AND** **the Centers** **column** **contains a** 2

There are 2 players who are both a **Varsity player AND a Center**

The **intersection** of the **Jr. Varsity Team** **row** **AND** **the Guards** **column** **contains a** 6

There are 6 players who are both a **Jr. Varsity player AND a Guard**

The **intersection** of the **Jr. Varsity Team** **row** **AND** **the Forward** **column** **contains a** 8

There are 8 players who are both a **Jr. Varsity player AND a Forward**

The **intersection** of the **Jr. Varsity Team** **row** **AND** **the Centers** **column** **contains a** 1

There is 1 player who is both a **Jr. Varsity player AND a Center**