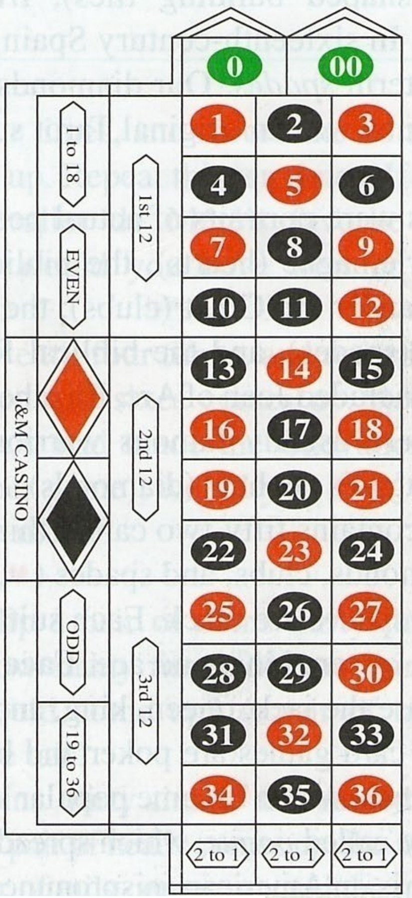
CASE: Roulette Wheel



Bet	House Odds
single number	35 to 1
two numbers ("split")	17 to 1
three numbers ("street")	11 to 1
four numbers ("square")	8 to 1
five numbers ("line")	6 to 1
six numbers ("line")	5 to 1
twelve numbers (column or section)	2 to 1
low or high (1 to 18 or 19 to 36, respectively)	1 to 1
even or odd (0 and 00 are neither even nor odd)	1 to 1
red or black	1 to 1

SOURCE: *Mathematics: A Practical Odyssey* by D.B. Johnson & T.A. Mowry

CASE: Roulette Wheel (cont.)

Bet	House Odds x to 1	Probability of Winning	Expected Gain	Variance	Std.Dev.
Single Number	35	0.02632	-0.05263	33.20776	5.76262
Two Numbers	17	0.05263	-0.05263	16.15512	4.01934
Three Numbers	11	0.07895	-0.05263	10.47091	3.23588
Four Numbers	8	0.10526	-0.05263	7.62881	2.76203
Five Numbers	6	0.13158	-0.07895	5.59903	2.36623
Six Numbers	5	0.15789	-0.05263	4.78670	2.18785
Twelve Number	2	0.31579	-0.05263	1.94460	1.39449
Low or High	1	0.47368	-0.05263	0.99723	0.99861
Even or Odd	1	0.47368	-0.05263	0.99723	0.99861
Red or Black	1	0.47368	-0.05263	0.99723	0.99861

CASE: Roulette Wheel

Example: Bet \$2 on a single number (e.g. 8)
$Y =$ \$ Amount Gained
Find the mean and variance of Y

Note Y = 2X

y_i	p_i

Rules for Means and Variances

Linear Transformations

$$z = a + bx$$

$$\bar{z} = a + b\bar{x}$$

$$s_z^2 = b^2 s_x^2$$

Rules for Means and Variances

Linear Transformations

If $Z = a + b X$ then

$\mu_Z = a + b \mu_X$

$\sigma_Z^2 = b^2 \sigma_X^2$

CASE: Roulette Wheel

Example: Bet \$1 on a single number (e.g. 8) two times
$Z =$ \$ Total Amount Gained
Find the mean and variance of Z

Note $Z = X_1 + X_2$

x_1	x_2	z	p_i

Rules for Means and Variances

Linear Transformations

If $Z = X_1 + X_2$ then

E[Z] = μ_Z = E$[X_1] + E[X_2] = \mu_1 + \mu_2$

If X_1 and X_2 are independent then

V[Z] = ${\sigma_Z}^2$ = $V[X_1] + V[X_2] = {\sigma_1}^2 + {\sigma_1}^2$

Conditional Probability

P(A|B) = The probability that A will occur given (knowing) that the event B will occur (or has occurred)

Example:

Draw two cards from a deck of cards

A = First card is an ace

B = Second card is an ace

Find:

P(A)

P(B|A)

P(B)

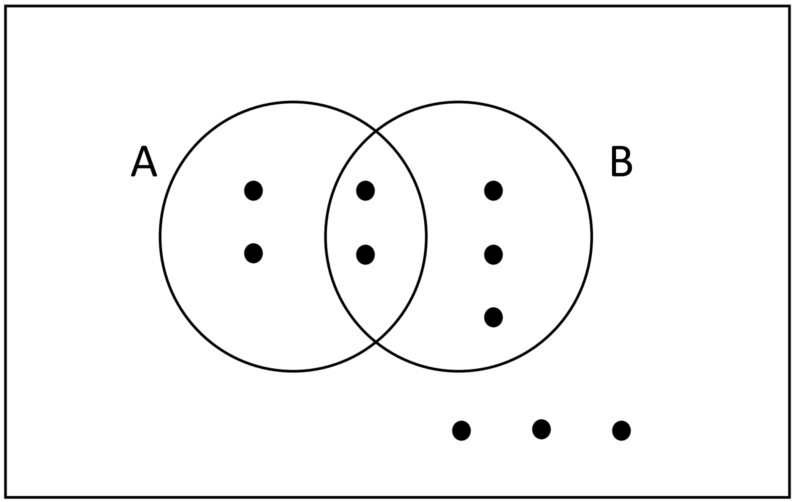
Conditional Probability

P(A|B) = The probability that A will occur given (knowing) that the event B will occur (or has occurred)

Mathematical Definition:

$$P(A \mid B) = \frac{P(A \cap B)}{P(B)} \qquad P(B) > 0$$

Conditional Probability



Assume all outcomes are equally likely

Find P(A|B)

Conditional Probability

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Find:

$P(A \cap B)$