Conditional Probability

The probability that B occurs given that event A occurs is called a conditional probability

$$P(B \mid A)$$

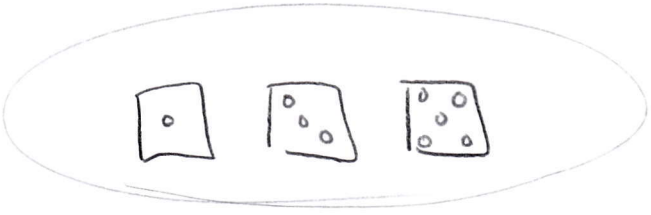
↖ "given"

Ex F = event roll a 5

O = event roll is odd

a) $P(F) = \frac{1}{6}$

b) $P(F \mid O) = \frac{1}{3}$



The Conditional Probability Rule

given odd  < changes our sample space)

If A and B are events and $P(A) > 0$, then

$$P(B \mid A) = \frac{P(A \text{ and } B)}{P(A)}$$

	C1	C2	C3	$P(R_i)$
R_1	0.24	0.08	0.12	0.44
R_2	0.10	0.20	0.26	0.56
$P(C_i)$	0.34	0.28	0.38	1.00

$$P(C_2 \mid R_1) = \frac{P(C_2 \text{ and } R_1)}{P(R_1)}$$

$$= \frac{0.08}{0.44}$$

$$P(A_4 \mid R_3) = \frac{P(A_4 \text{ and } R_3)}{P(R_3)} = \frac{36/1164}{320/1164} = \frac{0.031}{0.275} = 0.1125$$

Age (yr)	Full professor R_1	Associate professor R_2	Assistant professor R_3	Instructor R_4	Total
Under 30 A_1	A1 and R1: 2	3	57	A1 and R4: 6	68
30–39 A_2	52	170	163	17	402
40–49 A_3	156	125	61	6	348
50–59 A_4	145	68	A4 and R3: 36	4	253
60 & over A_5	75	15	3	0	93
Total	430	381	320	33	1164

Rank

$P(R_3) = \frac{320}{1164}$

$P(A_2) = \frac{402}{1164}$

$P(A_2 \text{ and } R_2) = \frac{170}{1164}$

$\frac{36}{320}$

Cells

R3 = the event that an faculty's rank is Assistant Prof.

A2 = the event that the faculty's age is 30-39.

A2 and R2