

The Infinite Actuary Exam 1/P Online Seminar
A.2 Conditional Probability Lecture Examples

A.2.1 Conditional Probability

Slide 2/29.

Suppose you roll a fair 6-sided die. *Given that the result is odd*, what is the probability that it is 3 or less?

Slides 3-4/29.

[Variations on SOA #6] A public health researcher examines the medical records of a group of 635 men who died in 1999 and discovers that 160 of the men died from causes related to heart disease. Moreover, 275 of the 635 men had at least one parent who suffered from heart disease, and, of these 275 men, 95 died from causes related to heart disease.

Determine the probability that a man randomly selected from this group died of causes not related to heart disease and that neither of his parents suffered from heart disease.

Determine the probability that a man randomly selected from this group died of causes not related to heart disease *given* that neither of his parents suffered from heart disease.

Slide 6/29.

[Variation on SOA #12; F.00.28] The blood pressure (high, low, or normal) and heartbeats (regular or irregular) of a random sample of patients are measured. Of the patients,

- (i) 36% have high blood pressure and 16% have low blood pressure.
- (ii) 21% have an irregular heartbeat.
- (iii) Of those with an irregular heartbeat, one-third have high blood pressure.
- (iv) Of those with normal blood pressure, one-eighth have an irregular heartbeat.

What portion have a regular heartbeat and low blood pressure?

Slide 8/29.

[SOA #13; S.01.09] An actuary is studying the prevalence of three health risk factors, denoted by A, B, and C, within a population of women. For each of the three factors, the probability is 0.1 that a woman in the population has only this risk factor (and no others). For any two of the three factors, the probability is 0.12 that she has exactly these two risk factors (but not the other). The probability that a woman has all three risk factors, given that she has A and B, is $\frac{1}{3}$.

What is the probability that a woman has none of the three risk factors, given that she does not have risk factor A?

Slides 12-14/29.

What is the probability of being dealt a flush after being dealt five cards from a standard deck?

(A flush is at least 5 cards from the same suit, and a standard deck has 4 suits each with 13 cards)

If exactly three of the first 5 cards dealt are spades, what is the probability of being dealt a flush in the first 7 cards?

If exactly four of the first 5 cards dealt are spades, what is the probability of being dealt a flush in the first 7 cards?

Slide 16/29.

An urn contains 10 balls: 4 red and 6 blue. A second urn contains 16 red balls and an unknown number of blue balls. A single ball is drawn from each urn. The probability that both balls are different colors is 0.528.

Calculate the number of blue balls in the second urn.

Slides 18-20/29.

A family has two children, and they are not twins. What is the probability that both children are boys?

A family has two children, and they are not twins. Given that at least one of the children is a boy, what is the probability that both children are boys?

A family has two children, and they are not twins. Given that the oldest child is a boy, what is the probability that both children are boys?

Slide 23/29.

[Variation on SOA #19; S.03.08] An auto insurance company insures drivers of all ages. An actuary compiled the following statistics on the company's insured drivers:

Age of Driver	Probability of Accident	Portion of Company's Insured Drivers
16-20	0.06	0.08
21-30	0.03	0.15
31-65	0.02	0.49
66-99	0.04	0.28

A randomly selected driver that the company ensures has an accident. Calculate the probability that the driver was 31-65.

Slide 27/29.

[Variation on SOA #20; S.01.6] An insurance company issues life insurance policies in three separate categories: standard, preferred, and ultra-preferred. Of the company's policyholders, 50% are standard, 40% are preferred, and 10% are ultra-preferred. The probability of dying in the next year is 0.010 for each standard policyholder, 0.005 for each preferred policyholder, and 0.001 for each ultra-preferred policyholder.

A policyholder dies in the next year. What is the probability that the deceased policyholder was standard?

Slides 28-29/29.

Taxicabs in Crobuzon are all either green or blue. On Tuesday, a taxicab got into an accident. A witness to the accident thought that the cab involved was blue, and further tests showed that the witness has an 80% chance of correctly identifying the color of a taxicab, independently of its color.

If 100% of the taxicabs on the streets on Tuesday were green, what was the probability that the taxicab involved in the accident was blue?

If 85% of the taxicabs on the streets on Tuesday were green, what was the probability that the taxicab involved in the accident was blue?