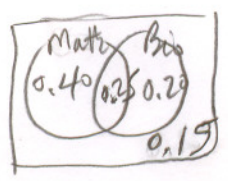


Solutions
By Dr. Katiraie



1. The probability of passing Professor Avila's math class is 65%, the probability of passing Professor Reid's biology class is 45%, and the probability of passing both is 25%. What is the probability of passing one or the other?

$$P(\text{Math or Bio}) = 0.40 + 0.25 + 0.20 = 0.85 = 85\%$$

2. Suppose the inside bottom of a box is painted with three colors: 1/3 of the bottom area is blue, 1/6 is red, and 1/2 is yellow. If you toss a tiny pebble into the box without aiming, what is the probability the pebble will not land on the color blue?

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

3. You have six socks in your drawer, three brown and three black. You get up early in the morning, while it is still dark, reach into your drawer, and grab two socks without looking. What is the probability that the socks are the same color?

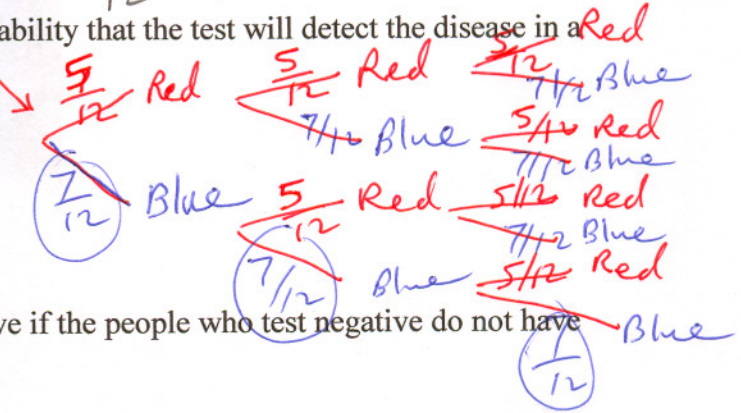
$$= \frac{3}{6} * \frac{2}{5} + \frac{3}{6} * \frac{2}{5} = \frac{12}{30} = 0.4 = 40\%$$

4. Suppose you pick a marble from a box containing five red and seven blue marbles. You record the color and put the marble back in the box. What is the probability of getting a blue marble each time if you do this three times?

$$\frac{7}{12} * \frac{7}{12} * \frac{7}{12} = \frac{343}{1728} \approx 19.85\%$$

5. The Sensitivity of a test is the probability that the test will detect the disease in a person who does have the disease.

- A) specificity
- B) sensitivity
- C) false positive
- D) true negative



6. The result of a medical test is a true negative if the people who test negative do not have the disease.

- A) True
- B) False

7. The prevalence of a disease in a given population is the percentage of the population that does not have the disease.

- A) True
- B) False

8. Conditional probability is the probability that one event occurs given that another has occurred.

9. ABC College is using a new screening test to test its employees for TB. The following table shows the results of a pilot study:

	Has TB	Does not have TB	Total
Test positive	42	26	68
Test negative	8	240	248
Total	50	266	316

What percentage of the individuals in the study were false negatives?

$$= \frac{8}{316} = 2.5\%$$

10. ABC College is using a new screening test to test its employees for TB. The following table shows the results of a pilot study:

	Has TB	Does not have TB
Test positive	42	26
Test negative	8	240

What percentage of the individuals in the study who had TB tested negative? $= \frac{8}{50} = 16\%$

11. ABC College is using a new screening test to test its employees for TB. The following table shows the results of a pilot study:

	Has TB	Does not have TB	Total
Test positive	42	26	68
Test negative	8	240	248
Total	50	266	316

For what percentage of the individuals in the study did the test return an incorrect result?

$$= \frac{8 + 26}{316} = 10.759\% \approx 10.8\%$$

12. The following table gives the results of a screening test for a disease:

	Has disease	Does not have disease
Test positive	25	32
Test negative	6	72

Estimate the sensitivity of the test. $= \frac{\text{tested positive}}{\text{have the disease}}$

$$= \frac{25}{31} = 80.6\%$$

13. The following table gives the results of a screening test for a disease:

	Has disease	Does not have disease
Test positive	25	32
Test negative	6	72

Estimate the specificity of the test. = $\frac{\text{True Negatives}}{\text{All who do not have it}} = \frac{72}{104} = 69.2\%$

14. You roll a fair six-sided die and don't look at it. What is the probability that it is 4, given that your friend looks and tells you that it is greater than 3?

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

15. In a standard deck of cards, the jack, queen and king are called "face cards." Suppose you draw a card from a standard deck and your friend peeks and lets you know it is a face card. What is the probability that it is a jack or queen given that it is a face card?

$$= \frac{8}{12} = \frac{2}{3}$$

16. The area of the United States is 3.79 million square miles, and Alaska covers 0.59 million square miles. Suppose a meteorite falls from the sky and strikes Earth. What is the probability it strikes Alaska given that it strikes the United States?

$$= \frac{0.59}{3.79} = 15.6\%$$

17. Susan bakes 10 chocolate chip and 10 peanut butter cookies. Will bakes 6 chocolate chip and 12 peanut butter cookies. The 38 cookies are put together and offered on a single plate. If you select a cookie at random from the plate, what is the probability that the cookie is peanut butter, given Will baked it?

	Susan	Will	Total
Chocolate	10	6	16
PB	10	12	22
Total	20	18	38

$$P(\text{PB} | \text{Will}) = \frac{P(\text{PB AND Will})}{P(\text{Will})} = \frac{12}{18} = \frac{2}{3}$$

18. Assume a population of 1,000,000 was tested for HIV. The following table shows the results:

	Infected	Not infected	Total
Test positive	99,900	900	100,800
Test negative	100	899,100	899,200
Totals	100,000	900,000	1,000,000

Find the probability that a person is infected with HIV, given that the person tested positive. Which of the four basic quantities (sensitivity, specificity, PPV, NPV) does this number present?

$$P(\text{HIV} | \oplus) = \frac{P(\text{HIV AND } \oplus)}{P(\oplus)} = \frac{99900}{100800} = 0.99107$$

TRUE Positive
All Positives

19. How many outcomes are possible if we toss 8 coins?

$$8 \leftarrow \text{No. of Coins}$$

$$2 = 256$$

$$= 99.1\%$$

