38. **a.** $0.60 \times 0.28 = 0.168$

b. $0.60 \times 0.39 + 0.40 \times 0.33 = 0.336$

39. True; Sensitivity gives the percent of people that have a condition given the fact that they tested positive.

40. True; Specificity gives the percent of people that don't have a condition given the fact that they tested negative.

41. True; Based on the definition of specificity.

42. True; Based on the definition of sensitivity.

43. True; Sensitivity gives the percentage of people that have a given condition.

44. True; Specificity gives the percentage of people that don't have a given condition.

45.
$$\Pr(\text{Hep}|\text{Pos.}) = \frac{(0.0005)(0.95)}{(0.0005)(0.95)+(0.9995)(0.1)} = \frac{0.000475}{0.000475+0.09995} = \frac{0.000475}{0.100425} \approx 0.00473$$

46.
$$\Pr(\text{TB}|\text{Positive}) = \frac{(0.02)(0.98)}{(0.02)(0.98)+(0.98)(0.01)} = \frac{0.0196}{0.0196+0.0098} = \frac{0.0196}{0.0294} = \frac{2}{3}$$

47.
$$\Pr(\text{Cond.}|\text{Positive}) = \frac{9}{19} \approx 0.474$$

48.
$$\Pr(\text{Cond.}|\text{Positive}) = \frac{13}{20} = 0.65 = 65\%$$

49.
$$\Pr(\text{Used}|\text{Positive}) = \frac{(0.05)(1)}{(0.05)(1)+(0.95)(.01)} = \frac{0.05}{0.05+.0095} = \frac{0.05}{0.0595} \approx 0.84 = 84\%$$

50.
$$\Pr(\text{Guilty}|\text{Pos.}) = \frac{(0.10)(0.88)}{(0.10)(0.88)+(0.9)(0.14)} = \frac{0.088}{0.088+0.126} = \frac{0.088}{0.214} \approx 0.4112 = 41.12\%$$

9. **a.** $(0.20 \times 0.20) + (0.15 \times 0.15) + (0.25 \times 0.12) + (0.30 \times 0.10) + (0.10 \times 0.10) = 0.1325$

b. $\Pr\left(\text{division C} \middle| \text{bilingual}\right) = \frac{0.25 \times 0.12}{0.1325} = \frac{0.03}{0.1325} = \frac{12}{53} \approx 0.23$

10. Pr(four 2-spot die|one 2-spot in six)

$$= \frac{\Pr(\text{four 2-spot die}) \times \Pr\left(\text{one 2-spot in six} \middle| \text{four 2-spot die}\right)}{\Pr(\text{four 2-spot die}) \times \Pr\left(\text{one 2-spot in six} \middle| \text{four 2-spot die}\right) + \Pr(\text{three 2-spot die}) \times \Pr\left(\text{one 2-spot in six} \middle| \text{three 2-spot die}\right)}$$

$$= \frac{\frac{1}{2} \times \left[6 \times \frac{4}{6} \times \left(\frac{2}{6}\right)^5\right]}{\frac{1}{2} \times \left[6 \times \frac{4}{6} \times \left(\frac{2}{6}\right)^5\right] + \frac{1}{2} \times \left[6 \times \frac{3}{6} \times \left(\frac{3}{6}\right)^5\right]}$$

$$= \frac{\frac{2}{3} \times \left(\frac{1}{3}\right)^5}{\frac{2}{3} \times \left(\frac{1}{3}\right)^5 + \left(\frac{1}{2}\right)^6}$$

$$\approx 0.1494$$

11. $\Pr\left(\text{cancer} \middle| \text{positive}\right) = \frac{\Pr(\text{cancer}) \times \Pr\left(\text{positive} \middle| \text{cancer}\right)}{\Pr(\text{cancer}) \times \Pr\left(\text{positive} \middle| \text{cancer}\right) + \Pr(\text{no cancer}) \times \Pr\left(\text{positive} \middle| \text{no cancer}\right)}$

$$= \frac{0.02 \times 0.75}{(0.02 \times 0.75) + (0.98 \times 0.30)} = \frac{5}{103} \approx 0.049$$

12. **a.** $$\Pr(\text{user}|\text{positive}) = \frac{\Pr(\text{user}) \times \Pr(\text{positive}|\text{user})}{\Pr(\text{user}) \times \Pr(\text{positive}|\text{user}) + \Pr(\text{nonuser}) \times \Pr(\text{positive}|\text{nonuser})}$$
$$= \frac{0.10 \times (1-0.02)}{[0.10 \times (1-0.02)] + (0.90 \times 0.05)}$$
$$= \frac{98}{143}$$
$$\approx 0.685$$

b. $(0.05)^2 = 0.0025$

c. $$\Pr(\text{nonuser}|\text{twice positive}) = \frac{\Pr(\text{nonuser}) \times \Pr(\text{twice positive}|\text{nonuser})}{\Pr(\text{nonuser}) \times \Pr(\text{twice positive}|\text{nonuser}) + \Pr(\text{user}) \times \Pr(\text{twice positive}|\text{user})}$$
$$= \frac{0.90 \times 0.0025}{(0.90 \times 0.0025) + [0.10 \times (0.98)^2]}$$
$$\approx 0.0229$$

13. **a.** $1 - 0.99 = 0.01$

b. $\Pr(\text{pregnant}|\text{positive})$
$$= \frac{\Pr(\text{pregnant}) \times \Pr(\text{positive}|\text{pregnant})}{\Pr(\text{pregnant}) \times \Pr(\text{positive}|\text{pregnant}) + \Pr(\text{not pregnant}) \times \Pr(\text{positive}|\text{not pregnant})}$$
$$= \frac{0.40 \times 0.99}{(0.40 \times 0.99) + (0.60 \times 0.02)} = \frac{33}{34} \approx 0.971$$

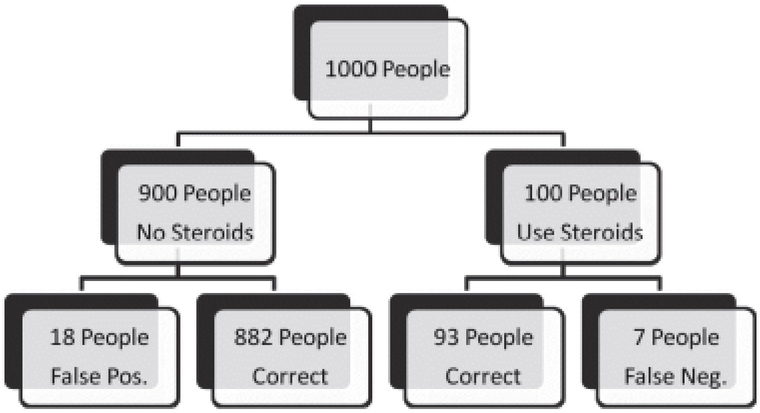
14. With 65% incidence, $$\Pr(\text{condition}|\text{pos}) = \frac{\Pr(\text{condition}) \times \Pr(\text{pos}|\text{condition})}{\Pr(\text{condition}) \times \Pr(\text{pos}|\text{condition}) + \Pr(\text{no cond.}) \times \Pr(\text{pos}|\text{no cond.})}$$
$$= \frac{0.65 \times 0.90}{(0.65 \times 0.90) + (0.35 \times 0.20)}$$
$$\approx 0.893$$

With 30% incidence, $$\Pr(\text{condition}|\text{pos}) = \frac{0.30 \times 0.90}{(0.30 \times 0.90) + (0.70 \times 0.20)} \approx 0.659$$

15. $$\Pr(\text{steroids}|\text{positive}) = \frac{\Pr(\text{steroids}) \times \Pr(\text{positive}|\text{steroids})}{\Pr(\text{steroids}) \times \Pr(\text{positive}|\text{steroids}) + \Pr(\text{no steroids}) \times \Pr(\text{positive}|\text{no steroids})}$$
$$= \frac{0.10 \times 0.93}{(0.10 \times 0.93) + (0.90 \times 0.02)} = \frac{31}{37} \approx 0.838$$

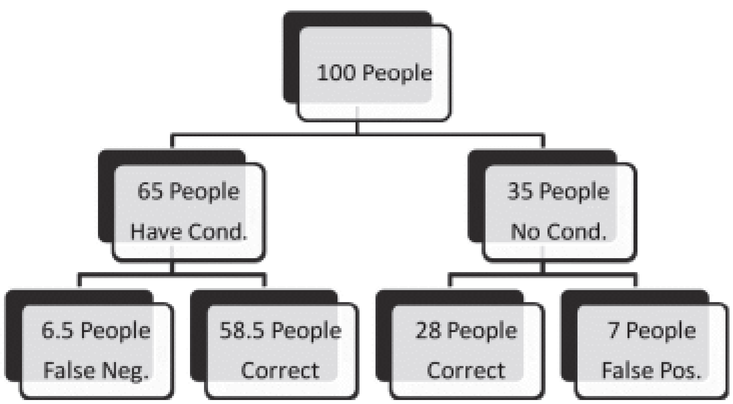
16. $$\Pr(\text{condition}|\text{positive}) = \frac{\Pr(\text{condition}) \times \Pr(\text{positive}|\text{condition})}{\Pr(\text{condition}) \times \Pr(\text{positive}|\text{condition}) + \Pr(\text{no condition}) \times \Pr(\text{positive}|\text{no condition})}$$
$$= \frac{0.05 \times 0.9}{(0.05 \times 0.9) + (0.95 \times \frac{11}{190})} = \frac{0.045}{0.045 + 0.055} = 0.45 = 45\%$$

27.

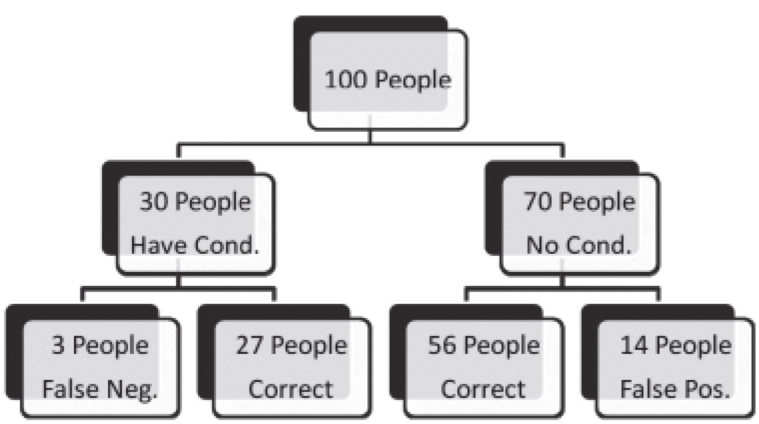


$$\Pr(\text{Used} \mid \text{Positive}) = \frac{93}{93+18} = \frac{93}{111} = \frac{31}{37} \approx 0.838$$

28.



$$\Pr(\text{Condition} \mid \text{Positive}) = \frac{58.5}{58.5+7} = \frac{58.5}{65.5} \approx 0.893$$



$$\Pr(\text{Condition} \mid \text{Positive}) = \frac{27}{27+14} = \frac{27}{41} \approx 0.659$$