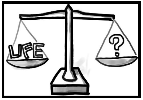
Role of chance and probability in real-world situations

...helped bring mathematics into a more tangible thought process for me and gave further insight to how conceptual ideas connect to the world around us and our personal lives.

- quantitative measure of a likelihood of an event from 0 to 1
- mathematical foundation of common sense and judgment
- law of large numbers
- experimental error provides an estimate of the inherent uncertainty associated with experimental procedures
- The probability of event E occurring =

$$\frac{\text{number of different outcomes in E}}{\text{total number of equally likely outcomes}}$$

- probability that an event will happen = 1 - it won't
- independent events have probabilities that multiply
- expected value—weighted average of probabilities
- x% confidence interval gives likelihood of obtaining true population response within a range of margin of error



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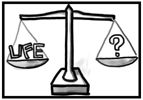
Let Test A be 95% accurate (sensitivity and specificity) and an independent Test B be 99% accurate. What is the probability that a positive person is actually infected?



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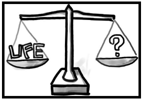
- How many infected people will test positive?



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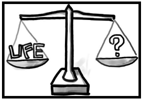
- How many infected people will test positive? $.95 \times .99 \times .001p = 0.0009405p$
- How many non-infected people will test + (false positives)?



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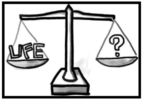
- How many non-infected people will test + (false positives)? $(1 - .95) \times (1 - .99) \times (p - .001p) = .05 \times .01 \times .999p = 0.0004995p$



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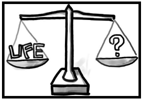
- Probability people with 2 + tests are actually infected? $0.0009405p/total$



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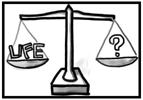
- Probability people with 2 + tests are actually infected?
  $0.0009405p/total =$
  $0.0009405p/(0.0009405p + 0.0004995p) = .653125.$



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- How many non-infected people will test + (false positives)? $(1 - .95) \times (1 - .99) \times (p - .001p) = .05 \times .01 \times .999p = 0.0004995p$
- Probability people with 2 + tests are actually infected? $0.0009405p/total =$ $0.0009405p/(0.0009405p + 0.0004995p) = .653125.$
- If Test A is positive and Test B is negative, probability of infection = 0.00019.