* Probabilistic reasoning
  + Sample space- set of all possible outcomes
  + an event, E, is any one set of outcomes of interest
  + the probability of an event, Pr(E) is the relative frequency of E over an indefinitely large number of trials
  + Pr(E) between 0 and 1
  + Additive law of probability
    - If E& F are mutually exclusive then PR(E or F) = Pr(E) + Pr(F)
    - example: coinflip
  + Multiplicative law of probability
    - if A&B are independent, Pr(intersection of A&B) = Pr(A) \* Pr(B)
  + Venn Diagram example
    - Pr(AUB = Pr(A) + Pr(B) – PR(A inter B)
  + Special cases
    - if A&B are mutually exclusive
      * Pr(AUB) = Pr(A) + Pr(B)
    - if A&B are independent
      * Pr(AUB) = Pr(A) + Pr(B) \* [1-Pr(A)]
  + Conditional probabilities
    - Multiplicative law works only for independent events
    - When events are not independent, we need to quantify dependence
  + Diseases
    - TB screening
    - a skin test SKT for TB
    - A positive skin test{SKT+} should be completely dependent on {TB}
    - (if these events are independent, then the test is useless)
    - Draw a venn diagram for SKT+, TB
    - Interested in the conditional probability (TB given SKT+)
    - Pr(SKT+ inter TB)/Pr(SKT+)
    - Generalized
      * conditional probability of B given A
        + Pr(B|A) = Pr(A inter B)/ Pr(A)
      * When A and B and independent then
        + Pr((B|A) = Pr(B) = Pr(B|!A))
    - Screening tests
      * Predictive value positive (PV+)
        + Pr(disease | test+)
      * Predictive value negative (PV-)
        + Pr(!disease | test-)
      * Relative rist (RR) given a positive test
        + Pr(disease|test+) / Pr(disease|test-)
    - TB example
      * Suppose 1 person in 100 who tests positive actually has TB
        + PV+, Pr(TB| SKT+)
      * Supposed 1 person in 10,000 whose test was negative actually has TB
        + Pr(TB|!SKT+)
      * Calculate PV- as Pr(!disease | test-) = 1-Pr(disease|test-)
      * Calculate RR as Pr(!disease| test+)/ Pr(disease| test-)
    - Symptoms, diseases & inference
      * Clinicians often cannot easily measure
        + Pr(disease|symptom)
      * Can measure how often symptoms appear in people with and without the disease
    - Sensitivity of screening test
      * Pr(symptom|condition)
    - Specificity of screening test
      * Pr(!symptom| !condition)
    - Bayes Rule relates to PV+, PV- to these
    - Bayes rule
      * Pr(B|A) = Pr(A|B) x Pr(B)/ Pr(A|B) x Pr(B) + Pr(A|B) x Pr(B)
  + Disease at the beach example
    - No single character trait predicts disease
      * no correlation found
    - Lotion as a predictor is better
  + RL considerations
    - TB skin test has many false positives
    - Still chosen because the best test in inconvenient
* Dealing with uncertainty (BIGFOOT)
  + Establishing truth
    - public opinion
    - Court of law
    - Science
  + Proof standards
    - proof beyond a reasonable doubt
      * perhaps >90%
    - clear and convincing evidence
      * >75%
    - Preponderance of the evidence
      * >50%
  + Criteria for evidence
    - Field that the evidence comes from
    - How evidence relates to claim
    - the suasive force of the evidence
  + Evaluating a field
    - Validity
      * field validity – real scientific field vs. pseudoscience
      * method validity – proper methodology followed
    - Competence
      * qualifications of expert
      * execution (competence on this occasion)
    - Clarity
      * Grice's maxims (quality/quantity/relevance/manner)
    - Bias
      * is the field biased?
      * Is an individual expert biased across all cases?
      * Is an individual expert biased in just this case?
  + Relation to claim
    - Stronger evidence
      * Data particular to the claim
      * directly supports a claim
      * circumstantial(requiring an inferential leap)
      * general topic knowledge
  + Suasive force
    - Ability to reason and make logical deductions
    - Presentation itself affects judgment
      * people have selective attention, perception, retention and evaluation
  + Dempster-Shafer
    - Generalization(relaxation) of Bayesian Probability
    - Allows us to define Belief with fewer restrictions
      * Subjective probability
    - Works when precise numbers cannot be measured
      * Ex. experts giving opinions
  + Quantifying uncertainty
    - for any hypothesis H:
      * Bel(H)
        + Belief(evidence supporting H) or a lower bound likelihood of H
      * Plaus(H)
        + Plausibility(evidence not contradicting H) or an upper bound for likelihood of H
    - In Dempster-Shafer
      * Belief and plausibility are defined over the set of all subsets of all possible worlds
  + Mass function
    - Assigning mass values based on probabilities
  + Relation to bigfoot
    - Either the film is authentic, or the documentary suffers from expert bias