Week 13, April 20th, 2015

9:30 – 10:20
Review of Homework 7 and Homework 8

- Solutions posted on course website
- We will revisit the DailyTemp (HW 7) and address the uncertainty of temperature on Wednesday and next week

10:20 – 10:45
Lecture

Expected value does not always lead to conclusions.

- How can we trust it in more complicated problems?
- What should actually guide our decisions?

Example 1:

- Square A → take $20 mill or $10 million
- Obvious choice is to take $20 mill

Example 1:

- Square A → 0.5 for 40M and 0.5 of $0
- Or → choice to take a SURE 10 mill
- = E(B) = $20

Example 3: Marker flipping game vs. $10,000,000 guaranteed

- Calculate the expected value of flipping game
    - E(X) = sum of where x = omega, x*P(X=x)
    - Decision tree

St. Petersberg paradox

- Consideration of a case where theoretical value was infinite
- Conclusion: expected value is not a reasonable guide for decisions
- Wednesday's class: expected utility
    - Satisfaction that life brings you – hard to quantify/monetize value

HW 8 Decision Tree Write-up

1.

A)

T: positive test

S: has disease

$P(S \mid T) = [P(S) * P(T \mid S)] / P(T)$

$P(S) = 1/1000$

$P(T \mid S) = 0.95$ //sensitive of test

$P(T \mid \sim S) = 1 - P(\sim T \mid S)$

$P(T) = P(T,S) + P(T,\sim S)$ ← Kolmogorov's first axiom

$P(T) = P(S)*P(T \mid S) + P(\sim S)*P(T \mid \sim S)$

$P(T) = 0.094$

$P(S \mid T) = P(S)P(T \mid S) / P(T) = 0.001*0.95/0.01094 = 0.086$ or 8.7%

B)

If you test everyone,

Costs

\$10 + 10 m people = \$100 m

\$50 x 10 m x P(T,~S) = \$50 m

Benefits

\$10,000 * 10 m x P(T, S) = \$95 m

Therefore, testing everyone was not a good option after doing cost-benefit analysis.

2.

A)

$E(0.5X + 0.5Y) = 0.5E(X) + 0.5E(Y) = 15$

B)

$var(0.5X + 0.5Y)=(0.5^2)*var(X) + (0.5^2)*var(Y) + 2*0.5*0.5*cov(X,Y)$

$var(0.5X + 0.5Y) = 41.75$