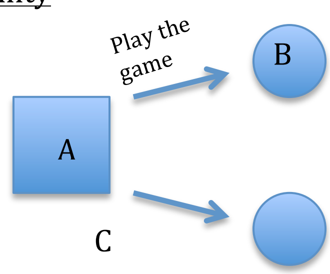
STA371H MW 9:30-11

4/22/15

<u>Utility</u>

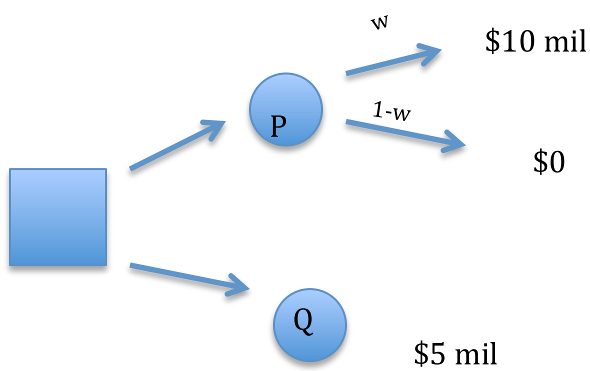


E[B]= ∞

Flipping game

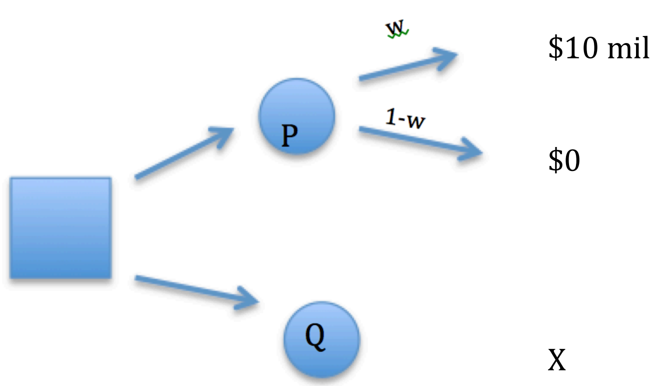
- Heads on flip k
- Payoff: $\$2^k$

<u>Simple Lottery</u>



E[P]=E[Q] if w=0.5

Let's say w=0.2, what would you set x to be?



If x=\$2 mil, you'd rather take the sure \$2 mil, if x=\$10 you'll probably flip

- Where is that trade off for you?
- You can measure your risk aversion here

Subjective utilities
Certainty equivalent (CE)

- CE[P] is the number K where you're indifferent between a sure thing of x taking the lottery P

Q ≻P   (Q is preferred to P)

P ≻ Q   (P is preferred to Q)

P=Q   (indifferent between P and Q)

≻ is called a preference relation

<u>Von Neumann Axions</u>

- Describe constraints on rational preference relationships
- Ex: ice cream vs brownie vs crème brulée
    - This would be an irrational set of preferences when you debate what you want, that debating is your preferences not meeting obvious standards of rationality

1. Your preferences are complete
    - For any options P,Q, either:
        - P ≻ Q
        - Q ≻ P
        - P=Q
2. Your preferences are transitive
    - P ≻ Q
    - Q ≻ R
        - => P ≻ R
        - so you aren't going crazy at dinner debating which of the three desserts to order
3. "Split the difference" rule
    - Ice cream, key lime pie, cheese (for dessert)
    - 100% to pie, or flip for cheese or ice cream
    - There's some weight w (like in previous diagrams) that splits the difference and weighs the best option and worse option (best being for sure key lime pie and you like it, worse being you don't like or want cheese for dessert, but love ice cream and would be willing to flip for it)
    - The w that makes me indifferent between lottery and pie
4. "Irrelevant option" rule
    - 2 options, ice cream to brownie, and you prefer ice cream
    - Add a 3rd option of being kicked in the stomach-> this option is irrelevant because you'd choose brownie or ice cream over being kicked any day
    - Irrelevant option does not change your original opinion

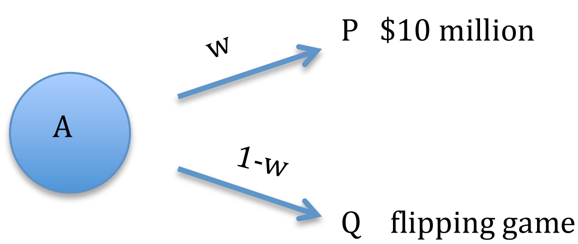
- You are fixed and certain in your preferences

Suppose 1-4 are satisfied (the axioms)…

- Then there exists a function U(A) such that
    1. For any lotteries Q and P and any w [0,1],
       $U(wP+(1-w)Q)=wU(P)+(1-w)U(Q)$
    2. For any lotteries P,Q
       $E(U(Q))>E(U(P))$ if and only if $Q \succ P$

Q and P are random variables
U is a function of that random variable

Statement 1, imagine utility (happiness) function of P and Q to rank the options



What is the expected utility of A?

$E(U(A))=wU(P)+(1-w)U(Q)$

$U(A)=E(U(A))$

Von Neumann-> your preference relation would say these two things are precisely equal

How much do you like option A?

$=U(A)$

Von Neumann relates how much you like option A to how much you like P and Q, then the amount you like A must be $=E(U(A))$

Utility function

- The graph would be logarithmic, $U(X)=\log(x)$
- The x axis would be millions of dollars, the y axis would be your happiness, the graph would increase logarithmically because there'd be a big increase between 0 and $1 million, but a smaller increase between $10million and $11 million, and that shows risk aversion

ON THE COMPUTER:

- Introduction to Monte Carlo simulation
- Use MonteCarloIntro.R on Week 13 on website
    - Use computer to simulate trajectories of portfolios over time
    - Build scenarios and find the implications of them

- For loop-> allows you to chain computations together and aggregate them over time, it's just like the normal compound interest formula, but this way we can make r_t sensitive to time
- Want to understand a distribution of the for loop with the random return-> Monte Carlo simulation-> take a histogram and can see the projected return you get
- W_t: wealth in year t
- $W_{t+1}=(1+r_t)w_t$