2011-11-28-EC01

Monday, November 28, 2011
6:13 PM

Course evaluations

e) Utility Theory

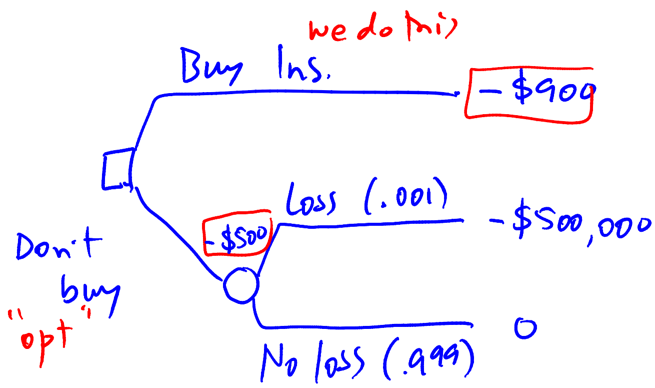
1) Utility

Ex. Insurance premium

$500,000

Pr(loss) = 0.001

premium = $900

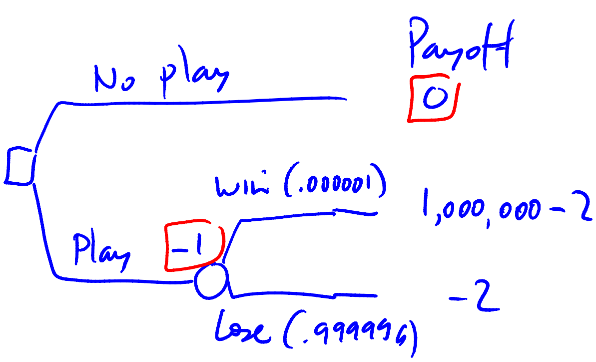


Risk-averse

Ex. Lottery ($2)

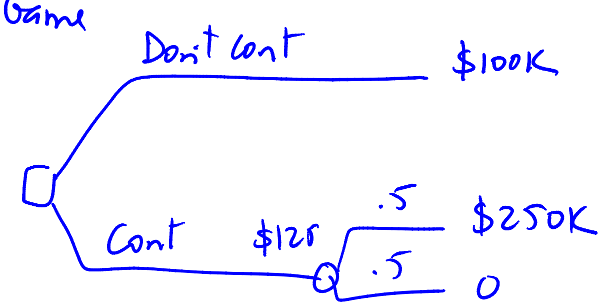
Pr(win) = .000001

↓ $1M



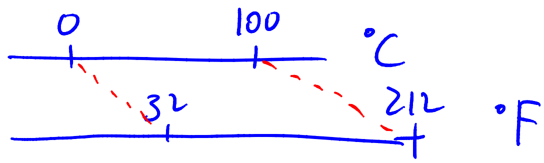
Risk-Seeking

Ex. Game



2. Measuring utility

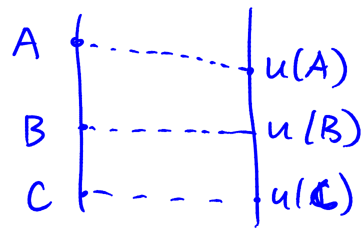
Interval scale (as in temp)



von Neumann & Morgenstern

Axioms of utility

①



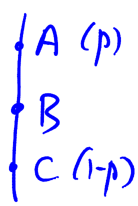
$A \succ B$: $u(A) > u(B)$

$A \succ C$: $u(A) > u(C)$

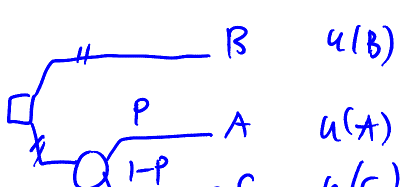
② If d.m. is <u>indifferent</u> between

a) outcome B for certain, and

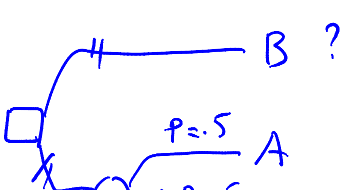
b) a lottery in which he receives A with prob. p, and C with prob 1-p., then



$$u(B) = \underbrace{p\,u(A) + (1-p)\,u(C)}_{\text{exp. utility of lottery}}$$

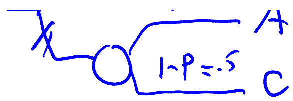


3. "Certainty equivalent" technique



$A \succ B \succ C$

$u(A)=100$ $u(C)=0$

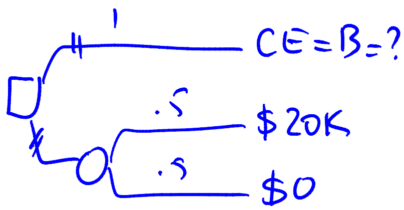


Ex. utility funct. for a student

$A = \$20K, \quad u(A) = 100$ "utils"

$C = \$0, \quad u(C) = 0$

Qn 1

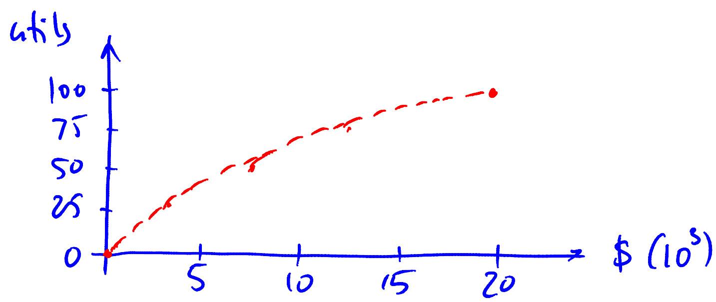


⇒ $8K

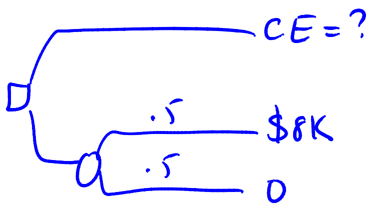
$u(B) = ?$

$$u(B) = p\,u(A) + (1-p)\,u(C)$$

$$= .5\,(100) + .5\,(0) = 50 \text{ utils}$$



Qn 2

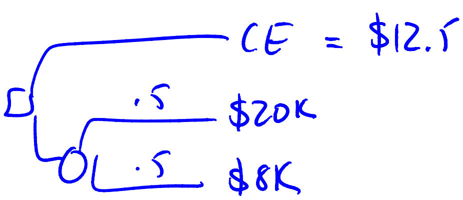


$3K, say

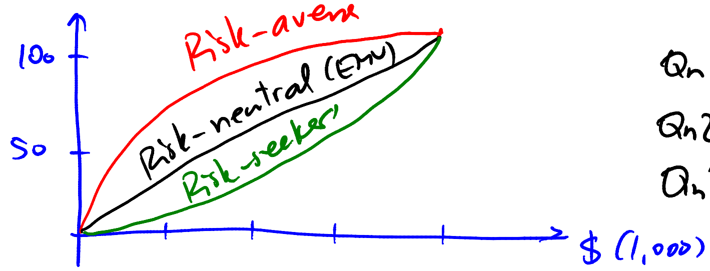
$$u(3K) = 0.5\,u(8K) + 0.5\,u(0)$$

$$= 0.5\,(50) + 0.5\,(0) = 25$$

Qn3



$u(12.5K) = .5\,u(20K) + .5\,u(8K)$
$= 75$



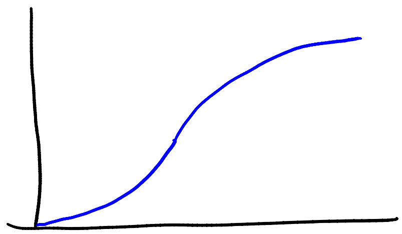
Risk-neutral

Qn 1: B = 10K

Qn 2: B = 4K

Qn 3: B = 14K

Friedman

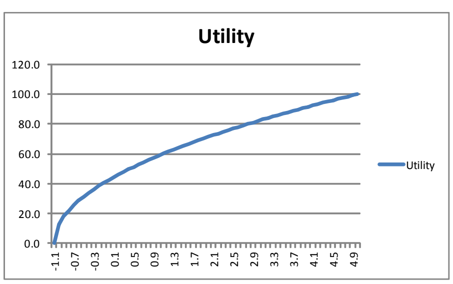


RP

Risk premium = EMV − CE

risk-avoider	RP > 0
" - neutral	RP = 0
" - seeker	RP < 0

Ex. Sunspotz



$-1.1 \leq x \leq 5.0$

$u(x) = 10\left(\frac{100}{6.1}(x+1.1)\right)^{1/2}$

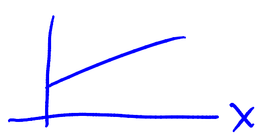
$u(-1.1) = 0$

$u(5) = 100$

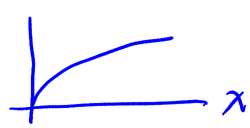
Optimal decision changes now.

<u>other utility functions</u>

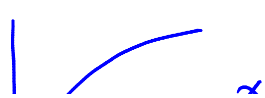
$u(x) = a + bx$ (linear)



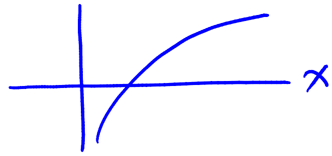
$u(x) = \sqrt{x}$ (power)



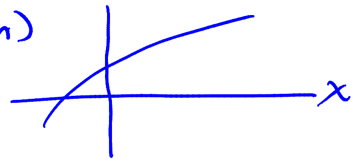
$u(x) = \log(x)$



$u(x) = \log(x)$



$u(x) = a - be^{-rx}$ (expon)



Pratt's risk aversion function

$$r(x) = -\frac{u''(x)}{u'(x)}$$

$u(x) = a + bx$, $\quad r(x) = 0$

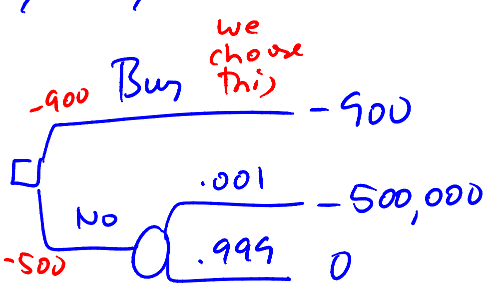
$u(x) = \sqrt{x}$, $\quad r(x) = \frac{1}{2x}$ decreasing

$u(x) = \log(x)$, $\quad r(x) = \frac{1}{x}$ "

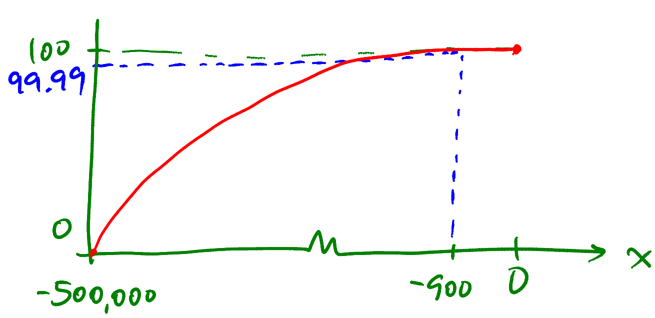
$u(x) = a - be^{-rx}$, $\quad r(x) = r$ constant

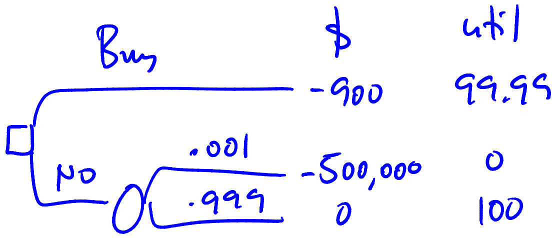
$u(x) = 10\left(\frac{100}{6.1}(x + 1.1)\right)^{1/2}$ decreasing $r(x)$

Ex. Why buy insurance?



even though ↗ is better



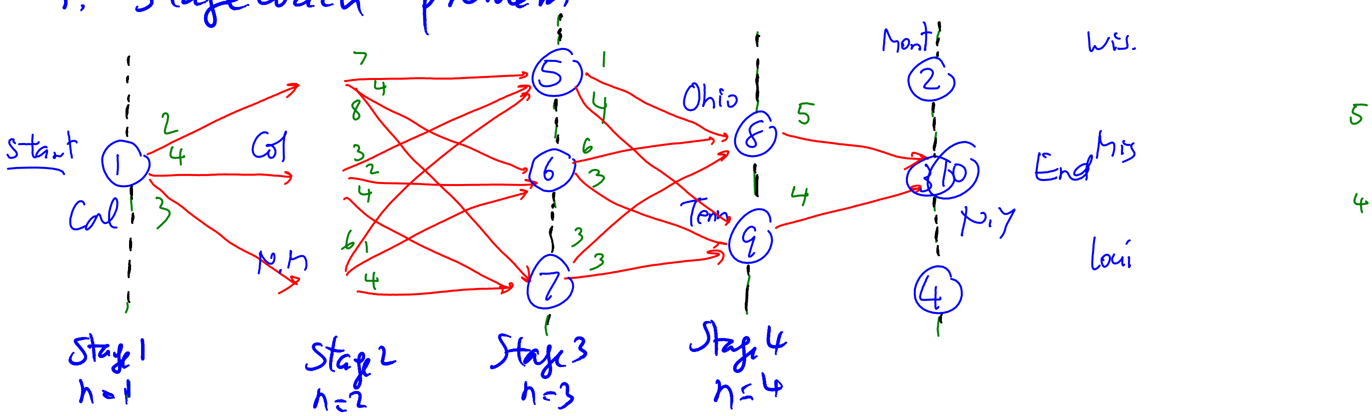


$EU(\text{Buy}) = 99.99$ ← Better

$EU(\text{No}) = 0\,(.001) + 100\,(.999) = 99.9$

Ch.10 Dynamic Programming

1. StageCoach problem



Q: What's cheapest route?

(1) Myopic Policy (Silly)

$① \overset{2}{—} ② \overset{4}{—} ⑥ \overset{3}{—} ⑨ \overset{4}{—} ⑩$; TC = \$13
wrong

(2) Brute force

$18 = 3 \times 3 \times 2 \times 1$ routes : Not efficient!

(3) D.P. approach