① AHP

1> reciprocal matrix (倒数矩阵) Synthesis

1、对每一列值相加

2、对元素除以所在列的总和

3、对每一行求平均值 平均值是 priority vector

2> Consistency 一致性

1、criteria pairwise comparison matrix * priority vector

2、step 1 得到的矩阵元素除以 priority vector

3、将 step 2 的矩阵值计算平均 λ_{max}

4、计算 $C.I. = \frac{\lambda_{max} - n}{n-1}$

5、$CR = \frac{CI}{RI}$ 如果 $CR < 0.1$ 则可接受 Acceptable.

3> 各候选人 in reciprocal matrix

计算 step 1 得到一个每个标准的优先级 priority vector

4> 综合优先级

step 3 的 matrix 乘以 step 1 的 priority vector

② Decision Tree

1、绘制 decision tree 时没有分概率的节点用"□"

有概率分支的节点用"○"

decision forks

event fork

Utility Theory

不同人对风险有不同的态度，效用可以衡量风险代替方案.

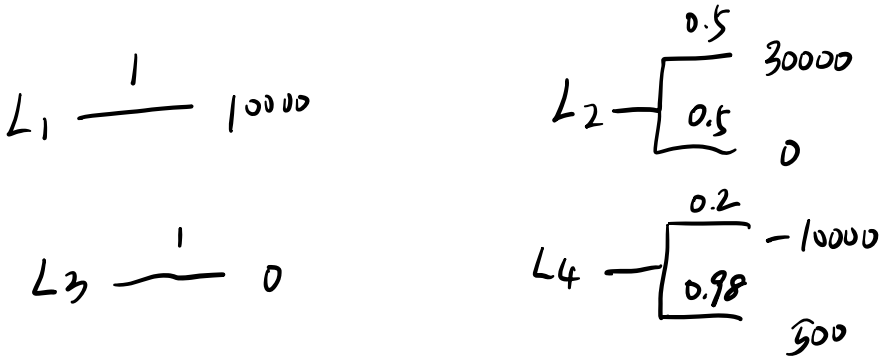
1> Von Neumann-Morgenstern Approach

$$E(U \text{ for } L) = \sum_{i=1}^{n} p_i u(r_i)$$

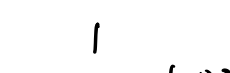
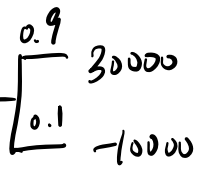
u(最不利) = 0

u(最有利) = 1

例：



则 u(30000) = 1 u(-10000) = 0

假设  和  无差

则 u(10000) = 1×0.9 + 0×0.1 = 0.9

同理可以得到 $u(1500) = 0.62$ $u(0) = 0$

则 $EU\text{ for } L_1) = 0.9 \times 1 = 0.9$

$EU\text{ for } L_2) = 0.5 \times 1 + 0.6 \times 0.5 = 0.8$

$EU\text{ for } L_3) = 1 \times 0.6 = 0.6$

$EU\text{ for } L_4) = 0.98 \times 0.62 = 0.6076$

2>

$CE(L)$: Certainty equivalent of lottery L

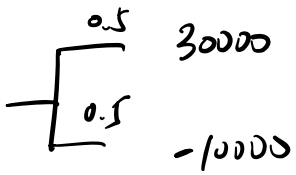
例:

则 $CE(L) = -3400$

$RP(L)$: risk premium of lottery L (风险溢价)

$RP(L) = EV(L) - CE(L)$

$EV(L)$是期望



$EV(L) = 0.5 \times (30000 - 10000)$

$= 10000$

$RP(L) = 10000 - (-3400) = 13400$

☆ $RP(L) > 0 \Rightarrow$ Risk-averse 风险规避型

$RP(L) < 0 \Rightarrow$ Risk-seeking 风险偏好型

$RP(L) = 0 \Rightarrow$ Risk-neutral 风险中性

3> Value of Information

插入 test 的价值： EV(after test) − EV(without test)

Expected Value of Sample Information (EVSI)

EVSI = EVWSI − EVWOI

EVWSI (with sample)：假设 test 不花钱得到 test 后的值

EVWOI (original)：不 test 的值

③ Decision Making under Uncertainty

1> Maximin (Criterion of pessimism)

2> Maximax (Criterion of optimism)

行 { 最小值in最大值 / 最大值in最大值

3> Hurwicz Criterion C_{OPT} - 乐观系数

期望payoff $H = C_{OPT}(\max \text{payoff}) + (1 - C_{OPT})(\min \text{payoff})$

期望cost $H = C_{OPT}(\min \text{cost}) + (1 - C_{OPT})(\max \text{cost})$

4> Criterion of regret (Savage criterion)

1. 计算每列最大值
2. 用最大值减各元素取绝对值
3. 取每行最大值，最大值in最小值为结果

5> Laplace Criterion

求每个策略in加权和(比如平均)，取最大