13.1 Introduction

partial or imperfect information leads to

A.Decisions under risk with probability associated values

B.Decisions under uncertainty value with out probability associated (unknown cannot be determined)

13.2 Decisions under risks

A.Expected value

－criterion is actual money or its utility function

(1) the value of money depends on the attitude toward the worth of money (utility)

(2) develop actual utility curve (money versus its utility)

(3) the use of expectation maybe misleading when only applied a few times (the difference sample mean and population mean)

－example

The prob. of machine breakdown is binomial distribution. with P_t. The cost of repair is C_1, the cost of maintaince is C_2. There is n machines, what is the best maintenance interval?

$EC(T-1) \geq EC(T)$ and $EC(T+1) \geq EC(T)$

$$EC(T) = \frac{C_1 \sum_{t=1}^{T-1} E(n_t) + C_2 n}{T}$$

binomial distribution. $\Rightarrow EC(T) = \dfrac{n\left(C_1 \sum_{t=1}^{T-1} P_t + C_2\right)}{T}$

	T	P_T	$\sum_{t=1}^{T-1} P_T$	EC(T)	
	1	0.05	0	500	
	2	0.07	0.05	375	
$T^* \rightarrow$	3	0.1	0.12	366.7	$\leftarrow EC(T^*)$
	4	0.13	0.22	400	
	5	0.18	0.35	450	

－example

廠商面臨應否產銷某一商品的決策問題，如產銷該產品則銷售量將有三種可能，每一情況下之報酬與機率預估如下：

行動與策略	銷售量		
	100單位（P1=0.4）	250單位（P2=0.4）	1000單位（P3=0.2）
S1：產銷該產品	- $ 3,000	0	$ 15,000
S2：不產銷該產品	0	0	0

S1的金錢期望值（EMV）：$E(S_1) = -3000 \times 0.4 + 0 \times 0.4 + 15000 \times 0.2 = 1800$

S2的金錢期望值（EMV）：$E(S_2) = 0 \times 0.4 + 0 \times 0.4 + 0 \times 0.2 = 0$

B.Expected value-variance criterion

－incorporated factor of variance to improve its applicability to " short-term " decision problems

－if σ^2 is smaller

(1) the variance of $\overline{Z}$ smaller

(2) the prob. that $\overline{Z}$ approaches E(Z) become larger

－possible criterion

Max. E(Z)- **K** var(Z)

where K is risk aversion factor (the degree of importance of var(Z) relative to E(Z) attitude toward excess deviation from expected value)

－example

$$C_T = \frac{C_1 \sum_{t=1}^{T-1} n_t + nC_2}{T}$$

$$Var(C_T) = \left(\tfrac{C_1}{T}\right)^2 \sum_{t=1}^{T-1} \mathrm{var}(n_t)$$

$$= \left(\tfrac{C_1}{T}\right)^2 \sum_{t=1}^{T-1} nP_t(1-P_t)$$

$$= n\left(\tfrac{C_1}{T}\right)^2 \left(\sum_{t=1}^{T-1} P_t - \sum_{t=1}^{T-1} P_t^2\right)$$

since $E(C_T)=EC(T)$

$\Rightarrow Min.\ \ EC(T) + K\,\mathrm{var}(C_T)$ set K=1

$\Rightarrow Max.\ \ EC(T) + \mathrm{var}(C_T)$

$$Min.\ EC(T)+K\,\mathrm{var}(C_T)$$

$$=n\left(\frac{C_1}{T}+\left(\frac{C_1}{T}\right)^2\sum_{t=1}^{T-1}P_t-\left(\frac{C_1}{T}\right)^2\sum_{t=1}^{T-1}P_t^2+\frac{C_2}{T}\right)$$

T_1	P_T	${P_T}^2$	$\sum_{t=1}^{T-1}P_T$	$\sum_{t=1}^{T-1}{P_T}^2$	$EC(T)+\mathrm{var}(C_T)$	
1	0.05	0.025	0	0	500	←T^*=1
2	0.07	0.0049	0.05	0.0025	6,312.5	
3	0.1	0.01	0.12	0.074	6,622.22	
4	0.13	0.0169	0.22	0.174	6,731.25	
5	0.18	0.0324	0.35	0.0343	6,764	

C.Aspiration-level criterion

—prespecificed level which is acceptable

(1) which may be two-level index that are conflicts

(2) accept it whenever first satisfies which may not be optimal

—for exmaple

(1) expected cost of operating system

(2) expected cost of customers inconvenience

—example

for a continuous density function, set a limits on expected excess quantity A_2 , expected shortage quantity level A_1 , $\int_I^\infty (X-I)f(x)dx\le A_1$,. $\int_0^I (I-X)f(x)dx\le A_2$

$$f(x)=\begin{cases}\frac{20}{X^2} & 10\le X\le 20\\ 0 & ,\ otherwise\end{cases}$$

$$\int_I^{20}(X-I)f(x)dx=\int_I^{20}(X-I)\tfrac{20}{X^2}\,dx$$

$$=20\left(\ln\tfrac{20}{I}+\tfrac{I}{20}-1\right)\le A_1$$

$$\int_0^I (I-X)f(x)dx=\int_{10}^I (I-X)\tfrac{20}{X^2}\,dx$$

$$=20\left(\ln\tfrac{10}{I}+\tfrac{I}{10}-1\right)\le A_2$$

$$\Rightarrow\begin{array}{l}\ln I-\tfrac{I}{20}\ge\ln 20-\tfrac{A_1}{20}-1\\ \ln I-\tfrac{I}{10}\ge\ln 10-\tfrac{A_2}{20}-1\end{array}$$

if A_1=2, A_2=4 $\quad\ln I-\tfrac{I}{20}\ge 1.896$, $\quad\ln I-\tfrac{I}{10}\ge 1.102$

I	10	11	12	13	14	15	16	17	18	19	20
$\ln I-\frac{I}{20}$	1.8	1.84	1.88	1.91	1.94	1.96	1.97	1.98	1.99	1.99	1.99
$\ln I-\frac{I}{10}$	1.3	1.29	1.28	1.26	1.24	1.21	1.17	1.13	1.09	1.04	0.99

－example

有一大型海鮮批發公司，該公司購進某種海鮮價格爲每箱250元，售出價爲每箱400元。所有購進的海鮮需當天售出，否則只能處理掉。根據過去統計資料，對該種海鮮的日需求量近似常態分配 $\mu = 650, o = 120$ 。試分別就下列情況決定批發公司的日最佳進貨量：

（1）沒有處理價

（2）當天處理價每箱240元

Sol：

（1）沒有處理價之情況

設日進貨量 x 箱，日需求量 y 箱，y ~ $N(650,120^2)$，f（y）爲 y 的機率密度函數

每天的期望剩餘數 = $\int_{-\infty}^{x}(x-y)f(y)dy$

設批發公司的日損益值爲 C(x,y)，則

$$E_y\{C(x,y)\} = (400-250)C\left[x-\int_{-\infty}^{x}(x-y)f(y)dy\right]-250\int_{-\infty}^{x}(x-y)f(y)dy$$

$$=150x-400x\int_{-\infty}^{x}f(y)dy+400\int_{-\infty}^{x}yf(y)dy$$

令 $\dfrac{dE_y\{C(x,y)\}}{dx}=0$ ，得

$$150-400\int_{-\infty}^{x}f(y)dy-400xf(x)+400xf(x)$$

$$=150-400\int_{-\infty}^{x}f(y)dy$$

因此，$\int_{-\infty}^{x}f(y)dy=0.375 \quad \Rightarrow P(y\le x)=0.375$

$$P(y\le x)=P\left(\frac{y-650}{120}\le\frac{x-650}{120}\right)=\Phi\left(\frac{x-650}{120}\right)=0.375$$

查表得，$\dfrac{x-650}{120}=-0.32$ 　　故日最佳進貨量 $x^*=611$ 箱

（2）當天處理價每箱240元之情況

$$E_y\{C(x,y)\}=150x-160x\int_{-\infty}^{x}f(y)dy+160\int_{-\infty}^{x}yf(y)dy$$

令 $\dfrac{dE_y\{C(x,y)\}}{dx}=0$ ，得

$$150-400\int_{-\infty}^{x}f(y)dy-160xf(x)+160xf(x)$$

$$=150-160\int_{-\infty}^{x}f(y)dy$$

因此，$\int_{-\infty}^{x}f(y)dy=0.9375 \quad \Rightarrow P(y\le x)=0.9375$

$$P(y\le x)=P\left(\frac{y-650}{120}\le\frac{x-650}{120}\right)=\Phi\left(\frac{x-650}{120}\right)=0.9375$$

查表得，$\dfrac{x-650}{120}=1.535$ 　　故日最佳進貨量 $x^*=834$ 箱

D.Most likely future criterion

—replace the random variable with a single value of highest prob. of occurrence as deterministic value

—the most probable future provide adequate information for decision making

—inadequate when

(1) a larger numbers of values which has a small prob. such as objective function

(2) several values with same highest probability

E.Experimental data is decisions under risk

—modify the prior probability to reflect the availability of new information as the posterior probability

—ultimate objective is to use these probability of sampling test together with prior probability to compute the posterior probability

$$P\{\theta_i | Z_j\} = \frac{P\{\theta_i, Z_j\}}{P\{Z_j\}} = \frac{P\{Z_j|\theta_i\}P\{\theta_i\}}{\sum_{k=1}^{m} P\{Z_j|\theta_k\}P\{\theta k\}}$$ (Bayes's Probability)

where $P\{\theta_i | Z_j\}$ given the experiment outcome Z_j , the probability of selecting θ_i

—example

The percentage of defect in lot 1 is 0.04 ,P(1)=0.95, while in lot 2 is 0.15, P(2)=0.05. If we test two items from the lot

Z_1=both are good

Z_2=one is good

Z_3=both are defect

$$P\{Z_1|\theta_1\} = C_2^2(0.96)^2(0.04)^0 = 0.9216$$

$$P\{Z_2|\theta_1\} = C_1^2(0.96)^1(0.04)^1 = 0.0768$$

$$P\{Z_3|\theta_1\} = C_0^2(0.96)^0(0.04)^2 = 0.0016$$

$$P\{Z_1|\theta_2\} = C_2^2(0.85)^2(0.15)^0 = 0.7225$$

$$P\{Z_2|\theta_2\} = C_1^2(0.85)^1(0.15)^1 = 0.255$$

$$P\{Z_3|\theta_2\} = C_0^2(0.85)^0(0.15)^2 = 0.0225$$

$$P\{Z_j, \theta_i\} = \begin{matrix} \\ \theta_1 \\ \theta_2 \end{matrix} \begin{Bmatrix} Z_1 & Z_2 & Z_3 \\ 0.9920 & 0.0768 & 0.0016 \\ 0.7225 & 0.2550 & 0.0225 \end{Bmatrix}$$

$$P\{\theta_i, Z_j\} = P\{Z_j|\theta_i\}P\{\theta_i\} = \begin{matrix} \theta_1 \\ \theta_2 \end{matrix}\begin{bmatrix} \overset{Z_1}{0.992} & \overset{Z_2}{0.0768} & \overset{Z_3}{0.0016} \\ 0.7225 & 0.225 & 0.0225 \end{bmatrix}\begin{bmatrix} 0.95 \\ 0.05 \end{bmatrix}$$

$$P\{\theta_i, Z_j\} = \begin{matrix} \theta_1 \\ \theta_2 \end{matrix}\begin{Bmatrix} \overset{Z_1}{0.87590} & \overset{Z_2}{0.07295} & \overset{Z_3}{0.00152} \\ 0.036125 & 0.01275 & 0.01125 \end{Bmatrix}$$

$$P\{Z_j\} = \{0.912025 \quad 0.08571 \quad 0.002645\}$$

$$P\{\theta_i|Z_j\} = \begin{matrix} \theta_1 \\ \theta_2 \end{matrix}\begin{Bmatrix} \overset{Z_1}{0.96039} & \overset{Z_2}{0.85124} & \overset{Z_3}{0.57467} \\ 0.03961 & 0.14876 & 0.42533 \end{Bmatrix}$$

－example

decision : ship the lot to customer A

ship the lot to customer B

A, B maximum limit on defect pertage is 5 and 8, respectively, over limit cost \$100 per percentage, lower limit cost \$80 per percentage.

$$C(a,\theta) = \begin{matrix} a_1 \\ a_2 \end{matrix}\begin{vmatrix} \overset{\theta_1}{80} & \overset{\theta_2}{1000} \\ 320 & 700 \end{vmatrix}$$

$$E(a_k|Z_j) = \sum_{\theta_i} C(a_k, \theta_j)P\{\theta_i|Z_j\}$$

(1) if test outcome is Z_1

$$E(a_1|Z_1) = 80 * 0.96039 + 1000 * 0.03961 = 116.49$$
$$E(a_2|Z_1) = 320 * 0.96039 + 700 * 0.3911 = 335.65$$

(2) if test outcomes is Z_2

$$E(a_1|Z_2) = 80 * 0.85124 + 1000 * 0.14876 = 216.86$$
$$E(a_2|Z_2) = 320 * 0.85124 + 700 * 0.14876 = 376.53$$

(3) if test outcomes is Z_3

$$E(a_1|Z_3) = 80 * 0.57467 + 1000 * 0.42533 = 471.30$$
$$E(a_2|Z_3) = 320 * 0.57467 + 700 * 0.42533 = 481.63$$

Example: 某石油公司考慮在某地鑿井，結果可能出現三種狀況：無油(θ_1)、油少量(θ_2)、油豐富(θ_3)。石油公司估計三種狀況出現的機率是：$P(\theta_1)=0.5$ ，$P(\theta_2)=0.3$ ，$P(\theta_3)=0.2$

鑿井費用是7萬元，如果少量出油，可收入12萬元，如大量出油，可收入27萬元。

為了進一步了解地質狀況可進行勘探，勘探結果可能是結構較差(s_1)、結構一般(s_2)、結構良好(s_3)，根據過去的經驗，地質結構與油井出油的關係如下：

	結構較差(s_1)	結構一般(s_2)	結構良好(s_3)
無油(θ_1)	0.6	0.3	0.1
油少量(θ_2)	0.3	0.4	0.3
油豐富(θ_3)	0.1	0.4	0.5

假設勘探費用需1萬元，問：（1）應先行勘探，還是直接鑿井

（2）應怎樣根據勘探結果來決定是否鑿井

Sol：令a_1為鑿井，a_2為不鑿井

（1）計算無條件機率$P(s_j)$和後驗機率$P(\theta_i|s_j)$

$$P(s_1)=P(s_1|\theta_1)P(\theta_1)+P(s_1|\theta_2)P(\theta_2)+P(s_1|\theta_3)P(\theta_3)$$

$$=0.6\times0.5+0.3\times0.3+0.1\times0.2=0.41$$

$$P(s_2)=P(s_2|\theta_1)P(\theta_1)+P(s_2|\theta_2)P(\theta_2)+P(s_2|\theta_3)P(\theta_3)$$

$$=0.3\times0.5+0.4\times0.3+0.4\times0.2=0.35$$

$$P(s_3)=1-0.41-0.35=0.24$$

$$P(\theta_1|s_1)=\frac{P(s_1|\theta_1)P(\theta_1)}{P(s_1)}=\frac{0.6\times0.5}{0.41}=0.7317$$

$$P(\theta_2|s_1)=\frac{P(s_1|\theta_2)P(\theta_2)}{P(s_1)}=\frac{0.3\times0.3}{0.41}=0.2195$$

$$P(\theta_3|s_1)=1-0.7317-0.2195=0.0488$$

同理可得：

$$P(\theta_1|s_2)=\frac{0.3\times0.5}{0.35}=0.4286$$

$$P(\theta_2|s_2)=\frac{0.4\times0.3}{0.35}=0.3428$$

$$P(\theta_3|s_2)=1-0.4286-0.3428=0.2286$$

$$P(\theta_1|s_3) = \frac{0.1 \times 0.5}{0.24} = 0.2083$$

$$P(\theta_2|s_3) = \frac{0.3 \times 0.3}{0.24} = 0.375$$

$$P(\theta_3|s_3) = 1 - 0.2083 - 0.375 = 0.4167$$

- 若探勘結果是結構較差(s_1)，則

$$E(a_1) = 0*0.7317 + 12*0.2195 + 27*0.0488 - 1 - 7 = -4$$
$$E(a_2) = -1$$

因此$a^* = a_2$，貝氏決策是不鑿井

- 若探勘結果是結構一般(s_2)，則

$$E(a_1) = 0*0.4286 + 12*0.3428 + 27*0.2286 - 1 - 7 = 2.29$$
$$E(a_2) = -1$$

因此$a^* = a_1$，貝氏決策是鑿井

- 若探勘結果是結構良好(s_3)，則

$$E(a_1) = 0*0.2083 + 12*0.375 + 27*0.4167 - 1 - 7 = 7.75$$
$$E(a_2) = -1$$

因此$a^* = a_1$，貝氏決策是鑿井

（2）若先行探勘，其最佳期望收益爲

$$E = -1*0.41 + 2.29*0.35 + 7.75*0.24 = 2.25$$

若不先行探勘，則

$$E(a_1) = 0*0.5 + 12*0.3 + 27*0.2 - 7 = 2$$
$$E(a_2) = 0$$

因此$a^* = a_1$，貝氏決策是鑿井，最佳期望收益是2萬元

因爲$2.25 > 2$，所以先行探勘

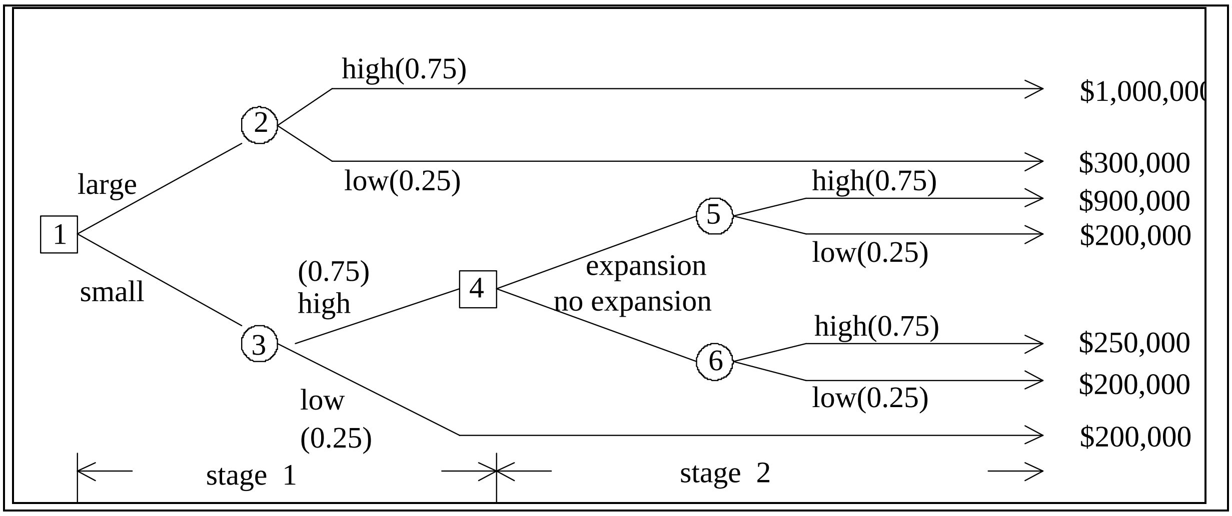
13.3 Decision Tress

A.Multiple-stages

B.A decision tree

□ : decision point ◯ : chance event

－example



stage 2 :

E{net profit｜expansion}= $(900*0.75+200*0.25)*8-4200=1600$

E{net profit｜no expansion}= $(250*0.75+200*0.25)*8=1900$

E{net profit｜large plant}= $(1000*0.75+300*0.25)*10-5000=3250$

E{net profit｜small plant}= $(1900+2*250)*0.75+200*10*0.25=1300$

Example:某咖啡製造商意識到他自己品牌的咖啡銷售已開始下降，爲了挽救這個局勢，有兩種措施可供選擇：增加廣告費，需要增加費用20萬元；改換品牌，估計要花費25萬元。經過市場調查得到這兩種措施對應的銷售額的機率分佈如下：

1. 維持現狀

年銷售額	550	450	300	250	150
機率	0.35	0.35	0.20	0.05	0.05

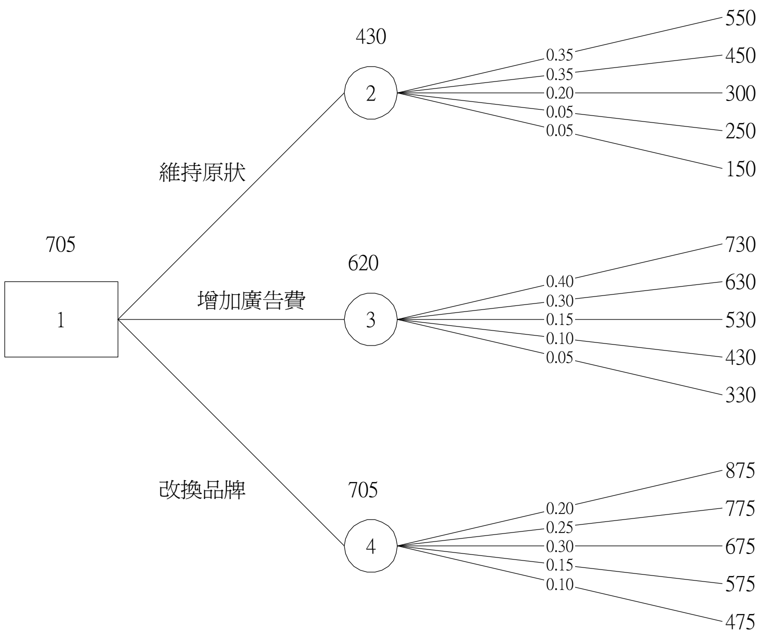
2. 增加廣告費

年銷售額	750	650	550	450	350
機率	0.40	0.30	0.15	0.10	0.05

3. 改換品牌

年銷售額	900	800	700	600	500
機率	0.20	0.25	0.30	0.15	0.10

問製造商應採何種措施才能使（年銷售額 - 措施費）的期望值最小？



計算各點的值：

點２：0.35*550+0.35*450+0.20*300+0.05*250+0.05*150=430

點３：0.40*730+0.30*630+0.15*530+0.10*430+0.05*330=620

點４：0.20*875+0.25*775+0.30*675+0.15*575+0.10*475=705

點１：與點 ４同

最佳決策爲改換品牌。

13.4 Decision under uncertainty

A.No probability is available

B.Have no intelligent opponent (nature)

C.Payoff table $P = (a_i, \theta_j)$: payoffs of possible actions under possible future state of event

D.Depends on decision attitudes from pessimistic to optimistic

E.Laplace criterion

－insufficient reasons principles

－assume sate are equality likely to occurs

$$\underset{a_i}{Max}\left\{\frac{1}{n}\sum_{j=1}^{n}P(a_i,\theta_j)\right\}$$

	θ_1	θ_2	θ_3	θ_4	$\frac{1}{n}\sum_{j=1}^{n}P(a_i,\theta_j)=\bar{P}$
a_1	5	10	18	25	14.5
a_2	8	7	8	23	11.5*
a_3	21	18	12	21	18
a_4	30	22	19	15	21.5

F.Minimax (Maximin) criterion

－most conservative

－make best out of the worst possible conditions

	θ_1	θ_2	θ_3	θ_4	Max.
a_1	5	10	18	25	25
a_2	8	7	8	23	23
a_3	21	18	12	21	21*
a_4	30	22	19	15	30

G.Savage minimax regret criterion

－less conservative

－loss matrix

$$r(a_i,\theta_j)=\begin{cases}\underset{a_k}{Max}\quad P(a_k,\theta_j)-P(a_i,\theta_j)\\ (a_i,\theta_j)-\underset{a_k}{Min}\quad P(a_k,\theta_j)\end{cases}$$

－minimize maximin regret (no matter less or profit)

		θ_1	θ_2	θ_3	θ_4	Max.
	a_1	0	3	10	10	10
$r(a_i,\theta_j)$	a_2	3	0	0	8	8
	a_3	16	11	4	6	16
	a_4	25	15	11	0	25

H.Hurwicz criterion

－range from optimistic to pessimistic

－set $\alpha = (0,1)$: index of optimism

$$profit: \underset{a_i}{Max}\left[\alpha \cdot \underset{\theta_j}{Max}\ P(a_i,\theta_j) + (1-\alpha)\cdot \underset{\theta_j}{Min}\ P(a_i,\theta_j)\right]$$

$$\cos t: \underset{a_i}{Min}\left[\alpha \cdot \underset{\theta_j}{Min}\ P(a_i,\theta_j) + (1-\alpha)\cdot \underset{\theta_j}{Max}\ P(a_i,\theta_j)\right]$$

－example

set $\alpha = \frac{1}{2}$

	$\min\limits_{\theta_j} P(a_i,\theta_j)$	$\max\limits_{\theta_j} P(a_i,\theta_j)$	$\alpha \cdot \min\limits_{\theta_j} p + (1-\alpha)\cdot \max\limits_{\theta_j} P$
a_1	5	25	15^*
a_2	7	23	15^*
a_3	12	21	16.5
a_4	15	30	22.5

Example:

（一）Maximax 法（樂觀法）

決策人員願冒最大風險以爭取最大報酬，故其選擇方法是從各方案中找出最大的報酬者，再從中選擇最大者，即爲大中取大的準則。

方案	未來情況 景氣	不景氣	各方案最大報酬	
1. 高級服飾店	$ 100,000	- $ 30,000	$ 100,000	Maximax
2. 一般服飾店	$ 50,000	$ 15,000	$ 50,000	
3. 出　　租	$ 20,000	$ 20,000	$ 20,000	

（二）Maximin 法（悲觀法）

決策人員是從最壞的情況作選擇，故其選擇方法是從各方案中找出最少的報酬者，再從中選擇最大者，即爲小中取大的準則。

	方案	未來情況 景氣	不景氣	各方案最大報酬	
1.	高級服飾店	$ 100,000	- $ 30,000	$ 100,000	
2.	一般服飾店	$ 50,000	$ 15,000	$ 50,000	
3.	出　　租	$ 20,000	$ 20,000	$ 20,000	Maximax

（三）Hurwicz Criterion（赫威茲準則）

一般人都不是極端樂觀或悲觀，而是偏於觀或悲觀。本準則選用一個介於 0 與 1 間之係數α，表示決策者的較樂觀或較悲觀的態度。

各方案的α加權平均報酬

$$=\alpha\times\text{各方案中的極大報酬}+(1-\alpha)\times\text{各方案中的極小報酬}$$

假設決策者是一位傳統型人物，對事情總是採取較保守的態度，因此他擬用α=0.2並使用赫威茲準則解決其問題。

	方案	未來情況 景氣	不景氣	各方案之α加權平均報酬	
1.	高級服飾店	$ 100,000	- $ 30,000	- $ 4,000	
2.	一般服飾店	$ 50,000	$ 15,000	$ 22,000	Max
3.	出　　租	$ 20,000	$ 20,000	$ 20,000	
	α加權	0.2	0.8		

張先生想開一家玩具工廠，但不知應開設大廠或小廠。經過估算後他認爲在未來各種情況下，大小廠之報酬如下：

	方案	未來情況 景氣	不好不壞	不景氣
1.	大　廠	$ 150,000	$ 65,000	- $ 100,000
2.	小　廠	$ 80,000	$ 50,000	- $ 10,000

張先生想以赫威茲準則解決其問題，由於他是一位喜愛冒險者，α=0.9，請問他因該開大廠或小廠。

大廠：150,000 * 0.9 +（-100,000）* 0.1 = 125,000　　較大
小廠： 80,000 * 0.9 +（- 10,000）* 0.1 =   71,000

（四）Equally Likely Criterion（相對可能準則）

決策者無法確知各情況出現的機率時，假設各情況出現的機率皆相等，或者決策者並未持特別樂觀或悲觀的態度時，可使用本準則。

假如張先生不對未來情況抱持樂觀或悲觀的看法時，請問張先生應選擇哪個方案？

大廠：(150,000 + 65,000 +（-100,000）) / 3 = 38,333
小廠：(80,000 + 50,000 +（- 10,000）) / 3 = 40,000　　較大

在此種準則下，張先生應選擇概小廠。

（五）Minimax 法（以機會成本計算之悲觀法）

本法與Maximin法類似，只不過Maximin法是計算各方案的報酬，而本法是計算各方案之機會損失。本法是先計算各方案在各情況下之機會損失，再選出各方案的最大機會損失，並從中選出最小者，是小中取大的準則。

	未來情況			
方案	景氣	不景氣	各方案之最大機會損失	
1. 高級服飾店	$ 0	$ 50,000	$ 50,000	Minimax
2. 一般服飾店	$ 50,000	$ 5,000	$ 50,000	Minimax
3. 出租	$ 80,000	$ 0	$ 80,000	

總結：(整個決策的過程)

—elements in decision theory
—act(a_i)
—event(θ_j)
—pay off table pay(a_i, θ_j)
—probability of θ_j
　—certainty
　—risk
　—uncertainty
—decision criteria
—optimal action