4 - Hurwicz criterion $\alpha = 0.6$

$Hv\ a_1 = 17500(0.6) + (1-0.6)(24000) = 20100$

$Hv\ a_2 = 15000(0.6) + 29000(0.4) = 20600$

$Hv\ a_3 = 10000(0.6) + 31000(0.4) = 18400$

$Min(20100, 20600, 18400) = 18400$

a_3 is the best alternative.

5 - Regret Matrix

	S_1	S_2	S_3	Max	Max
a_1	24000-15000 = 9000	21000-10000 = 11000	0	11000	11000
a_2	0	27500-10000 = 17500	29600-17500 = 11500	17500	
a_3	25000-15000 = 10000	0	31000-17500 = 13500	13500	

بما ان الجدول هو مصنوفه تكاليف فنبحث عن اقل قيمه من كل عمود وتطرح من باقي العناصر

a_1 is the best alternative

⑤ Savage Regret

strategies	states of Nature		
	S_1	S_2	S_3
a_1	5-2=3	0	1-1=0
a_2	4-2=2	3-2=1	3-1=2
a_3	2-2=0	6-2=4	1-1=0

$SV(a_1) = Max(3,0,0) = 3$

$SV(a_2) = Max(2,1,2) = 2$

$SV(a_3) = Max(0,4,0) = 4$

$Min(3,2,4) = 2$

a_2 is the bes alternative.

Decision Making in case of Risk

What distinguishes the state of uncertainty from the state of risk is that the risk environment is characterized by the availability of sufficient information that would enable the decision maker to determine the probability of the occurrence of each state of nature.

Therefore, in the event of a risk the decision maker can rely on quantitative criteria that help him make his decisions due to the multiplicity of natural states, but in light of the availability of sufficient information on the decision-making issue related to the environment. These criteria are represented in

① Expected Value of Returns
② Expected Value of missed opportunities
③ Expected Value of Complete Additional Information

② The most common state of nature standard

① The standard of expected value of returns depends in its calculations on the returns available for the alternatives subject to the decision-making process by multiplying the return value of each alternative and in each natural state by the probability of each natural state occuring

then, the results of the multiplication process are added for each of the available alternatives.

The expected value of the returns for each alternative is calculated using the following relationship

$$E(V_{i,j}) = \sum_{i,j=1}^{n} \rho_j R_{i,j}$$

where

$E(V_{i,j})$: Expected value of each alternative

ρ_j : probability of each state of nature

$R_{i,j}$: Returns available in the cells of the decision matrix

Make the decision using the expected value in the case of a returns or profit matrix

$$\text{Max } E(V_{i,j}) = \text{Max} \left[\sum_{i,j=1}^{n} \rho_j R_{i,j} \right]$$

Make the decision using the expected value in the case of a cost matrix

$$\text{Min } E(V_{i,j}) = \text{Min} \left[\sum_{i,j=1}^{n} \rho_j R_{i,j} \right]$$

② The most common state of nature standard

The mechanism for calculating the most common state of nature standard

The most likely state of nature criterion can be adopted using the following:-

First stage: we choose the state of nature that contains the greatest probability

second stage: we choose the alternative that has the greatest value in the case of returns and the least value in the case of costs

In the case of a return matrix we choose the state of nature that has Maximum probability and we choose the Maximum value of the state nature

In the case of a cost matrix we choose the state of nature that has Maximum probability and we choose the minimum value of the state of nature

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Example: A commerical company wants to choose The optimal strategy that yields the highest profits, and the return matrix for the company is as follows:-

Strategies Alternative	States of Nature			
	S_1	S_2	S_3	S_4
a_1	3	5	8	-1
a_2	6	5	2	0
a_3	0	5	6	4

What is the required is to determine the optimal strategy using:-

1. Optimist criterion
2. pessimist criterion
3. Laplace criterion
4. Hurwicz criterion $\alpha = 0.4$
5. Savage criterion
6. The expected value of returns
7. Expected value criterion for opportunity Less regret
8. The criterion for states of nature is the frequent occurrence

$p(S_1) = 0.6$, $p(S_2) = 0.1$, $p(S_3) = 0.2$, $p(S_4) = 0.1$