should be produced during that day. What is required is: a description of the .normal conditions and possible solutions for this problem

Solution :

The normal conditions are the production of batteries, that is: A(9), B(10), C(11), and D (12).Whereas A, B, C, and D were created to distinguish between the cases of that day, which are a(9), b(10), c(11), and d(12)

It is clear from the above that the decision in such a case must take into account orders for each state of nature. If, for example, the order is nine batteries while the factory produces nine batteries, in this case a question arises: Does the factory owner win or lose?

Or we assume that the order was for ten batteries while the factory produces nine batteries. In this case, the factory faces a loss of one unit, which represents cost and profit as well. Thus, the process of linking the results of every natural situation and every decision includes two situations: loss or profit. This point is the basic essence of statistical decision theory

Example (4)

Someone has a desire to invite a friend to a meal that consists of four types of foods: A, B, C, and D. This person has the knowledge of which of these four types of food a friend prefers. Required: Describe the states of nature and decision?

Solution :

For this problem, there are four states of nature, which represent the type of food, namely Q1, Q2, Q3, and Q4. As for the decisions, they can be obtained from the combination process :-

$$C_1^4 + C_2^4 + C_3^4 + C_4^4 =$$

$$4 + 6 + 4 + 1 = 15$$

Number of possible decisions.

Example (5)

Suppose you are offered the choice of selling ice cream or soft drinks in a football match. The size of the profits in these two choices is a function of the weather condition, which is represented by the types: sunny, overcast, and rainy. What is required: Identify the natural conditions and possible decisions?

Solution :

In this problem, the natural conditions represent the weather type, which is sunny, cloudy, and rainy. The possible decisions are

1- choose to sell ice cream

2- choose to sell refreshments

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worth function and worth table دالة القيمة وجدول القيمة

The necessary steps to be taken after determining the states of nature and possible decisions are to guess the possible outcomes of the relationship between each decision and each state of nature with a certain value. This step is considered the first or preliminary to guessing that relationship, and this guessing of the thing that happened with certain values is applied to it what is called the value

This value requires profit, cost, loss, or any value expressed in a specific monetary currency such as the dinar, dollar, pound, or other

In other words, this process can be described with a mathematical relationship. This function is called the Worth function, which is considered the initial representation of the possible results of the relationship between the state of nature and the possible decision. This value is either positive or negative, and .it is symbolized by the symbol W and represents w(d,Q)

If the states of nature and possible decisions represent a continuous random .variable, then the value function is w(d,Q)

Whereas if the states of nature and possible decisions represent a discrete random variable, then the form of the value function is as follows :

$$\mathbf{w}\left(d_i, Q_j\right), i = 1, 2, \dots\dots, n, \quad j = 1, 2, \dots\dots, m$$

So that the number of natural states is equal or not equal to the number of possible decisions, meaning that it is either m=n or m≠n

This can be represented by the following example

Example :

We assume that the price of a certain commodity is 30,000 and there has been an increase in the price of this commodity and the new price becomes 31,000. Suppose that a decision was made to purchase this new commodity, then what ?would the value function be in this case

In this case, the value function is (-1) thousand, which represents a negative While the opposite case will be when the price decreases and value or loss . Suppose a decision was made to purchase this commodity at becomes (29000) the new price

In this case, the value function is (+1) dinar, meaning it represents a positive value or profit for the decision maker

As for the value table, it is a special state or form of a specific matrix table such that its positive or negative value represents all the value functions for the problem under study or research. This table is classified vertically or horizontally with two elements, which are states of nature and possible decisions. If we have four states of normality and four decisions, that is, m =n=4 The value table will be represented as follows:-

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		Natural States			
		Q_1	Q_2	Q_3	Q_4
Possible decisions	d_1	$\mathbf{w}(d_1, Q_1)$	$\mathbf{w}(d_1, Q_2)$	$\mathbf{w}(d_1, Q_3)$	$\mathbf{w}(d_1, Q_4)$
	d_2	$\mathbf{w}(d_2, Q_1)$	$\mathbf{w}(d_2, Q_2)$	$\mathbf{w}(d_2, Q_3)$	$\mathbf{w}(d_2, Q_4)$
	d_3	$\mathbf{w}(d_3, Q_1)$	$\mathbf{w}(d_3, Q_2)$	$\mathbf{w}(d_3, Q_3)$	$\mathbf{w}(d_3, Q_4)$
	d_4	$\mathbf{w}(d_4, Q_1)$	$\mathbf{w}(d_4, Q_2)$	$\mathbf{w}(d_4, Q_3)$	$\mathbf{w}(d_4, Q_4)$

The value table can include three states of nature and four decisions. In other words, there is a possible inequality between the number of states of nature and the number of decisions, i.e. m≠n, m=3, n=4, and it is represented as follows :-

		Natural States		
		Q_1	Q_2	Q_3
Possible decisions	d_1	$\mathbf{w}(d_1, Q_1)$	$\mathbf{w}(d_1, Q_2)$	$\mathbf{w}(d_1, Q_3)$
	d_2	$\mathbf{w}(d_2, Q_1)$	$\mathbf{w}(d_2, Q_2)$	$\mathbf{w}(d_2, Q_3)$
	d_3	$\mathbf{w}(d_3, Q_1)$	$\mathbf{w}(d_3, Q_2)$	$\mathbf{w}(d_3, Q_3)$
	d_4	$\mathbf{w}(d_4, Q_1)$	$\mathbf{w}(d_4, Q_2)$	$\mathbf{w}(d_4, Q_3)$

The value table is also called the payoff

Example :- Referring to Example No. (4) above, we find that the cost of the (four types of foods is A=8,B=7,C=6,D=5)

Suppose that the person who invites his friend to a meal will receive a reward .of 15 dinars if he knows his friend's taste

Create a value table for this problem?

Solution : In this example, we have four states of nature and we have K = 15 decisions obtained from using compatibility previously, so the table becomes as follows:

	A=8	B=7	C=6	D=5	**Choose a type Of the food**
	Q_1	Q_2	Q_3	Q_4	
d_1	K-A=7	-A=-8	-A=-8	-A=-8	**A**
d_2	-B=-7	K-B=8	-B=-7	-B=-7	**B**
d_3	-C=-6	-C=-6	K-C=9	-C=-6	**C**
d_4	-D=-5	-D=-5	-D=-5	K-D=10	**D**
d_5	K-(A+B)=0	K-(A+B)=0	-(A+B)=-15	-(A+B)=-15	**AB**
d_6	K-(A+C)=1	-(A+C)=-14	K-(A+C)=1	-(A+C)=-14	**AC**
d_7	K-(A+D)=2	-(A+D)=-13	-(A+D)=-13	K-(A+D)=2	**AD**
d_8	-(B+C)=-13	K-(B+C)=2	K-(B+C)=2	K-(B+C)=-13	**BC**
d_9	-(C+D)=-11	-(C+D)=-11	K-(C+D)=4	K-(C+D)=4	**CD**
d_{10}	-(B+D)=-12	K-(B+D)=-3	-(B+D)=-12	K-(B+D)=3	**BD**