d_{11}	K-(A+B+C)=-6	K-(A+B+C)=-6	K-(A+B+C)=-6	-(A+B)=-21	**ABC**
d_{12}	K-(A+B+D)=-5	K-(A+B+D)=-5	-(A+B+D)=-20	K-(A+B+D)=-5	**ABD**
d_{13}	K-(A+C+D)=-4	-(A+C+D)=-19	K-(A+C+D)=-4	K-(A+C+D)=-4	**ACD**
d_{14}	-(B+C+D)=-18	K-(B+C+D)=-3	K-(B+C+D)=-3	K-(A+C+D)=-3	**BCD**
d_{15}	-(A+B+C+D)=-11	-(A+B+C+D)=-11	-(A+B+C+D)=-11	-(A+B+C+D)=-11	**ABCD**

Through the table values, we notice how the value 7 was obtained for the first decision and under the state of nature No 1

Answer

This value of 7 was obtained by subtracting the cost of food A from the reward of 15 dinars, which represents a profit for the decision maker (the first person). The reason is that the decision in this case is decision number one and under the state of nature number 1

As for the second value -8, it represents a loss and is equivalent to the remainder of the reward of 15 dinars that he did not enjoy as a result of the first .decision, in favor of food type A, and so on for the rest of the values

note

Taking into consideration the reward of 15 dinars and dealing with the cost according to each decision

Example:

Referring to Example No. (2), where the cost of the three types of dairy is (50, 40, and 30) dinars. Assume that the company owner will obtain a reduction of (90) dinars from the raw materials for the dairy if he knows what the consumer prefers. What is required is to compose a value table?

solution:

We have three states of nature which represent the three types of milk.

According to consensus, we have seven decisions, so the value table becomes as follows:

Note: For the horizontal table, we obtained the value 40

Cost - A the amount of reduction

90-50=40....the amount of profit

While if he chooses B or C, the amount of loss will be -50, which is the cost of A, knowing that he did not benefit from the amount of the reduction, which is (90) dinars. And so on for the rest of the values in the table.

-50	-50	40
-40	50	-40
60	-30	-30
-90	0	0
10	-80	10
20	20	-70
-30	-30	-30

Utility function and utility table دالة المنفعة وجدول المنفعة

After forming the important elements of the problem in decision theory, which are represented by states of nature and possible decisions, as well as performing logical steps subject to certain considerations, in light of which the appropriate decision or the best among the possible decisions can be obtained, and for this we need another or subsequent numerical evaluation that represents the preferences of the decision maker Table

Suppose, for example, a problem consisting of three states of nature, A, B, and C, and that the decision maker prefers A over B and C, and that this simple preference can be expressed numerically through any function symbolized by the letter U, which means representing it with any specific value, i.e. each of A, B and C can be written as follows :

U(A)>U(B)>U(C)

For example

U(A=10 ; U(B)=0.5 ; U(C)=0)

Or in another way

U(A=100 ; U(B)=93 ; U(C)=-10)

The goal of this is to find a special case expressed by U(d,Q), which is called the utility function

In addition, the value table does not give the final values based on which we choose the best decisions, as the value table may contain many negative numbers that represent a loss to the decision maker in terms of its value, and this depends .on the nature of the problem under study

Or in other words, this table is not the final result of the possible results of the relationship between the decision and the state of nature, and therefore one must think about creating another table called the utility table or values to .indicate the level of benefit

Therefore, through it, we can reduce negative numbers by taking into account the constraints of the problem under study, for example, discount or reduction .considerations, or tax considerations in insurance companies, etc

The goal of these considerations is to achieve certain benefits for the decision maker, an example of which is the following

Example:

Referring to Example No. (4) above, assuming that an unused or uneaten meal or type of food can be returned for half the price. It is required to create a utility table

D1	*7*	*-4*	*-4*	*-4*	*A*
	-3.5	*8*	*-3.5*	*-3.5*	*B*
	-3	*-3*	*9*	*-3*	*C*
	-2.5	*-2.5*	*-2.5*	*10*	*D*
	0	*0*	*-2.5*	*-7.5*	*AB*
	1	*-7*	*1*	*-7*	*AC*
	2	*-6.5*	*-6.5*	2	*AD*
	-6.5	*2*	*2*	*-6.5*	*BC*
	-6	*3*	*-6*	*3*	*BD*
	-5,.5	*-5.5*	*4*	*4*	*CD*
	-6	*-6*	*-6*	*-10.5*	*ABC*
	-5	*-5*	*-10*	*-5*	*ABD*
	-4	*-9.5*	*-4*	*-4*	*ACD*
	-9	*-3*	*-3*	*-3*	*BCD*
	-11	*-11*	*-11*	*-11*	*ABCD*

جدول المنفعة المعياري: *Standard Utility*

The basis for forming the values of the standard utility table is the utility table. If the values from it that we obtain are final values after taking all additional considerations into consideration, we notice that there are still negative values. Therefore, the alternative that we are considering is the standard utility table, which requires the condition to be as follows :-

1-This table must be free of negative numbers

2-The smallest value must be equal to zero

3 -Every measured value must be in one unit, meaning that all values in it must be integer and not fractional

The method in which the table unit is reached is, for example, by adding or multiplying by a certain amount or dividing the table by a certain value, that is, we arrive at a table with one scale.

Example : Referring to Example No. (4) types of foods, 15 decisions, we get the following standard table

Required: Find the standard utility table

D1	36	14	14	*14*	*A*
	15	38	15	15	*B*
	16	16	40	16	*C*
	17	17	17	42	*D*
	22	22	7	7	*AB*
	24	8	24	8	*AC*
	26	9	9	26	*AD*
	9	26	26	9	*BC*
	10	*28*	*10*	*28*	*BD*