Multiple choice decision making

Name of student

Name of professor

University

Course

Date

Decision problem

For this particular problem, we are going to consider a case whereby a farmer would like to choose a geographical location for his farm location, the geographical locations are in three main sites that include the highlands, lowlands and the plane lands. The following are some of the characteristic features that the farmer is looking for:

- Rain above 300ml per month
- Soil fertility (Nitrogen content of above 40%)
- Soil ph. of between 5-8
- Salinity value of not more than 0.3

In trying to arrive at his multiple choice decision making problems, the following is the summary of the matrix problems:

Land location	**Salinity**	**PH**	**Fertility**	**Rainfall**
Uplands				
Low lands				
Plain lands				

Question 1:

The choice benefit of each selection is based on an independent alternative for each location and they are as follows:

The probability tool used for this calculation is found on

https://www.calculator.net/probability-calculator.html

For calculating one variable on salinity:

Result

Given: $P(A)=0.8$ & $P(A \cap B)=0.4$

$$P(B) = \frac{P(A \cap B)}{P(A)}$$
$$= \frac{0.4}{0.8}$$
$$= 0.5$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$
$$= 0.8 + 0.5 - 0.4$$
$$= 0.9$$

$$P(A \Delta B) = P(A) + P(B) - 2P(A \cap B)$$
$$= 0.8 + 0.5 - 2 \times 0.4$$
$$= 0.5$$

$$P(A') = 1 - P(A)$$
$$= 1 - 0.8$$
$$= 0.2$$

$$P(B') = 1 - P(B)$$
$$= 1 - 0.5$$
$$= 0.5$$

$$P((A \cup B)') = 1 - P(A \cup B)$$
$$= 1 - 0.9$$
$$= 0.1$$

Generated confidence level;

z	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	0	0.00399	0.00798	0.01197	0.01595	0.01994	0.02392	0.0279	0.03188	0.03586
0.1	0.03983	0.0438	0.04776	0.05172	0.05567	0.05962	0.06356	0.06749	0.07142	0.07535
0.2	0.07926	0.08317	0.08706	0.09095	0.09483	0.09871	0.10257	0.10642	0.11026	0.11409
0.3	0.11791	0.12172	0.12552	0.1293	0.13307	0.13683	0.14058	0.14431	0.14803	0.15173
0.4	0.15542	0.1591	0.16276	0.1664	0.17003	0.17364	0.17724	0.18082	0.18439	0.18793
0.5	0.19146	0.19497	0.19847	0.20194	0.2054	0.20884	0.21226	0.21566	0.21904	0.2224
0.6	0.22575	0.22907	0.23237	0.23565	0.23891	0.24215	0.24537	0.24857	0.25175	0.2549
0.7	0.25804	0.26115	0.26424	0.2673	0.27035	0.27337	0.27637	0.27935	0.2823	0.28524
0.8	0.28814	0.29103	0.29389	0.29673	0.29955	0.30234	0.30511	0.30785	0.31057	0.31327
0.9	0.31594	0.31859	0.32121	0.32381	0.32639	0.32894	0.33147	0.33398	0.33646	0.33891
1	0.34134	0.34375	0.34614	0.34849	0.35083	0.35314	0.35543	0.35769	0.35993	0.36214

Result

Probability of A occuring 4 time(s) = $0.8^4 = 0.4096$

Probability of A NOT occuring = $(1 - 0.8)^4 = 0.0016$

Probability of A occuring = $1 - (1 - 0.8)^4 = 0.9984$

Probability of B occuring 4 time(s) = $0.2^4 = 0.0016$

Probability of B NOT occuring = $(1 - 0.2)^4 = 0.4096$

Probability of B occuring = $1 - (1 - 0.2)^4 = 0.5904$

Probability of A occuring 4 times and B occuring 4 times = $0.8^4 \times 0.2^4 = 0.00065536$

Probability of neither A nor B occuring = $(1 - 0.8)^4 \times (1 - 0.2)^4 = 0.00065536$

Probability of both A and B occuring = $(1 - (1 - 0.8)^4) \times (1 - (1 - 0.2)^4) = 0.58945536$

Probability of A occuring 4 times but not B = $0.8^4 \times (1 - 0.2)^4 = 0.16777216$

Probability of B occuring 4 times but not A = $(1 - 0.8)^4 \times 0.2^4 = 2.56E\text{-}6$

Probability of A occuring but not B = $(1 - (1 - 0.8)^4) \times (1 - 0.2)^4 = 0.40894464$

Probability of B occuring but not A = $(1 - 0.8)^4 \times (1 - (1 - 0.2)^4 = 0.00094464$

	Probability	Repeat Times
Event A	0.8	4
Event B	0.2	4

Land location	Salinity	PH	Fertility	Rainfall
Uplands	0.8	6.9	80%	90%
Low lands	0.4	5.0	50%	60%
Plain lands	5.9	3.2	10%	15%

Suppose the famer would like to grow coffee, his selection is most likely to pay off in the uplands regions, while if he did the same for animal beef rearing, his selection is likely to make sense in the plain lands regions where it will pay off.

Question 2

The selections may not be the same for all the 4 variable checks under selection that is salinity, pH, nitrogen content and rainfall.

Question 3

Suppose we are to use a weighted scoring model for this:

Land location	Salinity	PH	Fertility	Rainfall
Uplands	8/17	7/15	8/14	9/14
Low lands	4/17	5/15	5/14	6/14
Plain lands	5/17	3/15	1/14	2/14
Total score	12	15	14	17

Each and every selection made for these options have their own downsides and upsides, however for maximum output, the famer would then consider the maximum total output resulting from each selection as follows:

Land location	Salinity	PH	Fertility	Rainfall	Total
Uplands	0.47	0.47	0.57	0.64	2.15
Low lands	0.24	0.33	0.36	0.43	1.36
Plain lands	0.29	0.2	0.07	0.14	0.7
Total score	12	15	14	17	58

AHP Analysis

Suppose the famer would like to grow coffee, his selection is most likely to pay off in the uplands regions, while if he did the same for animal beef rearing, his selection is likely to make sense in the plain lands regions where it will pay off.

Land location	Salinity	PH	Fertility	Rainfall	Total
Uplands	0.47	0.47	0.57	0.64	2.15
Low lands	0.24	0.33	0.36	0.43	1.36
Plain lands	0.29	0.2	0.07	0.14	0.7
Total score	12	15	14	17	58

From the results, it can be seen that uplands is more preferred since it has got the weighted scoring model based on the input selections made for each variable type.

REFRENCES

https://www.calculator.net/probability-calculator.html