INSTITUTO TECNOLÓGICO DE AERONÁUTICA
DIVISÃO DE ENGENHARIA MECÂNICA

MOQ-12 PROBABILIDADES E INT. A PROCESSOS ESTOCÁSTICOS 1^0 Sem. 07

Série de Exercícios 3ª: Aplicações de Valor Esperado em Análise de Decisão

1. Case da Família Morgan:

Dan Morgan precisa decidir-se logo. Sua situação profissional está se deteriorando, porém um novo e interessante trabalho apresentam-lhe complicações.

Dan, 52, e sua esposa Doris, 45, têm dois filhos: Sarah, 16, estudante no segundo ano do segundo grau, e Nick, 13, cursando a oitava série, ambos em escolas particulares. Eles moram em uma residência confortável, em um subúrbio de Arlington, em Boston. Doris, professora primária, trabalha em uma cidade vizinha. Sente-se cansada pelas exigências da disciplina de seu trabalho, e mal paga pelo salário anual de US$ 42 mil que recebe.

Dan é especialista em informática — não um analista de sistemas ou engenheiro de computação, o que é um problema — e vende programas para a empresa Omega Software. No passado vitorioso, hoje a Omega atravessa uma fase de dificuldades. Nos últimos três anos, a empresa vem demitindo inúmeros representantes de vendas, e Dan acha que é só uma questão de tempo até que o demitam, ou tentem convencê-lo a uma aposentadoria precoce.

Ele recebe um salário anual de US$ 50 mil, mais bonificações e comissões que já chegaram a US$ 40 mil em anos anteriores, porém caíram recentemente para cerca de US$ 15 mil. Apesar disso, com o salário de Doris, os Morgan se consideram em situação financeira confortável. Mas, e se Dan perdesse o emprego? Não seria fácil encontrar outro igual na idade dele.

Entra em cena uma nova possibilidade. Dan tem trabalhado com freqüência junto a Bill Brown, sócio de uma promissora rede de empresas na área de computação, a DotCom Communications, em Amherst, Massachusetts, a cerca de 160 km de distância. Brown lhe oferecera um emprego na área de vendas de software e sistemas, por um salário anual de US$ 60 mil, mais comissões que podem variar entre US$ 10 mil e US$ 40 mil por ano. A DotCom está crescendo, e Dan sente que, se aceitar o emprego, seu futuro estará relativamente seguro. A empresa precisa contratar alguém com urgência, portanto, ele tem apenas uma semana — no máximo três — para decidir se aceita ou não.

Dan e Doris atuam em conjunto na tomada de todas as decisões sérias que afetam a família — e essa, certamente, pode ser qualificada como séria. Os dois se sentam para trabalhar.

Discuta como procederia se você estivesse no lugar de Dan Morgan.

2. Exercício do Churrasco

(a) Suppose you are planning a party, and your objective is to have an enjoyable party for all the guests. An outdoor barbecue would be the best, but only if the sun shines: rain would make the barbecue terrible. On the other hand, you could plan an indoor party.
This would be a good party, not as nice as an outdoor barbecue in the sunshine but better than a barbecue in the rain. Of course, it is always possible to forego the party altogether!
Construct an influence diagram and a decision tree for this problem.

(b) You will, naturally, consult the weather forecast, which will tell you that the weather will be either "sunny" or "rainy". The forecast is not perfect, however. If the forecast is "sunny", then sunshine is more likely than rain, but there still is a small chance that it will rain. A forecast of "rainy" implies that rain is likely, but the sun may still shine.
Now draw an influence diagram for the decision, including the weather forecast.
Now draw a decision tree for this problem. Recall that the events and decisions in a decision tree should be in chronological order

3. Exercício do Paciente

(a) Imagine that a close friend has been diagnosed with heart disease. The physician recommends bypass surgery. The surgery should solve the problem. When asked about the risks, the physician replies that a few individuals die during the operation, but most recover and the surgery is a complete success. Thus, your friend can (most likely) anticipate a longer and healthier life after the surgery. Without surgery, your friend will have a shorter and gradually deteriorating life. Assuming that your friend's objective is to maximize the quality of her life, diagram this decision with both an influence diagram and a decision tree.

(b) Suppose now that your friend obtains a second opinion. The second physician suggests that there is a third possible outcome: Complications from surgery can develop which will require long and painful treatment. If this happens, the eventual outcome can be either a full recovery, partial recovery (restricted to a wheelchair until death) or death within a few months. How does this change the decision tree and influence diagram that you created in part 1? Draw the decision tree and the diagram influence that represent the situation after hearing from both physicians.

4. Case: Drive Tek Research Institute

Drive Tek Research Institute discovers that a computer company wants a new tape drive for a proposed new computer system. Since the computer company does not have research people available to develop the new drive, it will subcontract the development to an independent research firm. The computer company has offered a fee of $250,000 for the best proposal for developing the new tape drive. The contract will go to the firm with the best technical plan and the highest reputation for technical competence.

Drive Tek Research Institute wants to enter the competition. Management estimates a cost of $50,000 to prepare a proposal with a fifty-fifty chance of winning the contract.

However, Drive Tek's engineers are uncertain about how they will develop the tape drive if they are awarded the contract. Three alternative approaches contract. Three alternative approaches can be tried. The first approach is a mechanical method with a cost of $120,000, and the engineers are certain they can develop a successful model with this approach. A second approach involves eletronic components. The engineers estimate that the eletronic approach will cost only $50,000 to develop a model of the tape drive, but with only a 50 percent chance of satisfactory results. A third approach uses magnetic components; this costs $80,000, with a 70 percent chance of success.

Drive Tek Research can work on only one approach at a time and has time to try only two approaches. If it tries either the magnetic or eletronic method and the attempt fails, the second choice must be the mechanical method to guarantee a successful model.

The management of Drive Tek Research needs help in incorporating this information into a decision to proceed or not.

5. Case: Investing in the Stock Market (Part 1)

An investor has some funds available to invest in one of three choices: a high-risk stock, a low-risk stock or a saving account that pays a sure $500. If he invests in the stock, he must pay a brokerage fee of $200.

His payoff for two stocks depends on what happens to the market. If the market goes up, with probability 0.5; he will earn $1700 from the high-risk stock and $1200 from the low-risk stock. If the market stays at the same level, with probability 0.3 his payoff for the high- and low-risk stocks will be $300 and $400, respectively. Finally if the stock market goes down, with probability 0,2 he will lose $800 with the high-risk stock but still gain $100 with the low-risk-stock.

a) Use a decision tree to recommend a decision and find the VME.

6. Case: Gorman Manufacturing Company

The Gorman Manufacturing Company must decide whether to manufacture a component part at its Milan, Michigan, plant or purchase the component part from a supplier. The resulting profit is dependent upon the demand for the product. The following payoff table shows the projected profit (in $000s).

	State of Nature		
	Low Demand	Medium Demand	High Demand
Decision Alternative	**s_1**	**s_2**	**s_3**
Manufacture, d_1	-20	40	100
Purchase, d_2	10	45	70

The state-of-nature probabilities are $P(s_1) = 0,35$, $P(s_2) = 0,35$, and $P(s_3) = 0,30$.

a) Use a decision tree to recommend a decision.
b) Use VEIP to determine whether Gorman should attempt to obtain a better estimate of demand.

A test market study of the potencial demand for the product is expected to report either a favorable (F) or unfavorable (U) condition. The relevant conditional probabilities are as follows:

$P(F| s_1) = 0.10$ $P(U| s_1) = 0.90$
$P(F| s_2) = 0.40$ $P(U| s_2) = 0.60$
$P(F| s_3) = 0.60$ $P(U| s_3) = 0.40$

What is the probability that the market research report will be favorable?

c) What is Gorman's optimal decision strategy?
d) What is the expected value of the market research information?
e) What is the efficiency of the information? where Efficiency of information = VEII/VEIP

7. Case: Investing in the Stock Market (Part 2)

Suppose that the investor could consult an expert with perfect information – a clairvoyant – who could reveal exactly what the market would do.

a) Find the VEIP – Valor Esperado com Informação Perfeita

Suppose that the investor hires an economist who specializes in forecasting stock market trends. Because he can mistakes, however, he is not a clairvoyant, and his imformation is imperfect. For example suppose his tack record shows that if the market actually will rise, he says “up” 80% of the time, “flat” 10% and “down” 10%

The table below is constructed to characterize his perfomance in probabilistic terms.The probabilities therein are conditional, for example:

P(Economists says “flat”/flat) = 0,70

b) Find the VEII – Valor Esperado com Informação Imperfeita

		True market state	
Economist’s prediction	Up	Flat	Down
“Up”	0,80	0,15	0,20
“Flat”	0,10	0,70	0,20
“Down”	0,10	0,15	0,60
	1,00	1,00	1,00