

COB291, Section \_\_\_\_\_ or Time of Class \_\_\_\_\_

### Home Work Decision Analysis

*I have read and understand the explanation of the JMU Honor Code in the syllabus for this class. I also understand that violations will be reported to the JMU Honor Council and heavily penalized. I pledge that I have neither given nor received assistance from anyone other than Dr. Ping Wang on this assignment.*

Student Name: (Please print) \_\_\_\_\_ Peoplesoft ID \_\_\_\_\_

Student Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Check list:

	Grade		Grade
Deduct 1 point if no Cover page		HW Decision Analysis 2	
Deduct 1 point if the HW is not stapled		3) Deduct 1 point if No Decision Tree One	
Percent finish of Problem 22 on pp. 792		4) Deduct 1 point if No decision Tree Two	
Percent finish of Problem 24 on pp. 793		5) Deduct 2 points if No Summary Report	
Percent finish of Case 15.2 on pp. 797		6) Deduct 1 point if No Sensitivity Analysis	
HW Decision Analysis 2			
1) Deduct 1 point if worksheets without gridlines or headings			
2) Deduct 1 point if worksheets without formulas			

NOTES:

1. One points will be deducted if the cover page is not used or is not check - marked appropriately
2. One points will be deducted if it is not stapled

Homework 3 Decision Analysis:

HW 3 Decision Analysis 0: be sure to read the text book on Decision Analysis and understand the examples in the text and in the lecture notes.

**HW 3 Decision Analysis 1:** Decision Analysis 1 has three problems from Spreadsheet Modeling and Decision Analysis, 5<sup>th</sup> Edition, Ragsdale, 2007:

- 1) Problem 22 on page 792,
- 2) Problem 24 on page 793 and
- 3) Case 15.2 on page 797.

They are reproduced in the back of this assignment for convenience. The solutions for these three problems are given on Blackboard for your reference. You do not need to hand them in.

HW Decision Analysis 2 is on the next three pages.

You should complete this assignment according to the COB291 Instructions for Homework. Please print copies of the following items to turn in before the class.

1. Cover sheet with your name and a statement that you complete the assignment by yourself.
2. Worksheet showing your work for each of the items requested with gridlines and row/column headings
3. Be sure to show formulas for computations on the worksheet and print out formulas with Excel@ Formulas/Show Formulas with gridlines and row/column headings.
4. Worksheet showing the two decision tree models, formatted to fit on one sheet for each decision tree model.
5. One page of formulas for each decision tree model to show links to values of probabilities, payoffs and names on the separate worksheet developed.
6. Your managerial summary report as a word document.
7. Get on course Blackboard Digital Dropbox to Add and Send your Excel@ file.

### HW 3 Decision Analysis 2

Pittsburgh Development Corporation (PDC) has purchased land for a luxury, riverfront condominium complex. The site provides a spectacular view of downtown Pittsburgh and the Golden Triangle where the Allegheny and Monongahela rivers meet to form the Ohio River. The individual units will be priced from \$300,000 to \$1,200,000, depending on the floor the units is located on, the square footage of the unit, and optional features such as fireplaces and large balconies.

The company has had preliminary architectural drawings developed for three different project sizes: a Small complex with 6 floors and 30 units, a Medium complex with 12 floors and 60 units, and a Large complex with 18 floors and 90 units. The management believes the possible market acceptance of the project as either High market acceptance and hence a substantial demand for the units, or Low market acceptance and hence a limited demand for the units.

Payoff Table (\$ million)		
	High Demand	Low Demand
Small Complex	10	8
Medium Complex	16	6
Large Complex	25	-12

Select the decision alternative with the follow decision rules:

1. MaxiMax
2. MaxiMin
3. MiniMax Regret

Suppose PDC is optimistic about the project with an initial subjective probability assessment of 0.9 that market acceptance will be High and a corresponding probability of 0.1 that the market acceptance will be Low.

4. Select the decision alternative with the decision rule that will maximize the expected value.
5. Use Excel@ TreePlan to construct a decision tree model on a separate worksheet for the case, to construct the payoff table and the prior probabilities for the market acceptance on a different worksheet, and link appropriate values of probability, payoffs and names to your decision tree (you do not type in names and values for your Decision Tree), What decision strategy should be used to maximize EMV? Does that confirm the best alternative with the maximum expected value as that in item 4 above?
6. Conduct sensitivity analysis in Excel@ Data/What If Analysis/Data Table with the probability of High demand changing from 0.0 to 1.0 with 0.1 increments to see the change of choice of the decision alternatives.
  - a. What is the Probability of High demand at which the Small complex is the best alternative that maximize the expected value.

- b. What is the Probability of High demand at which the Medium complex is the best alternative that maximize the expected value.
  - c. What is the Probability of High demand at which the Large complex is the best alternative that maximize the expected value.
7. Draw a Scatter chart with your sensitivity table as a graphical sensitivity analysis to show the change of selection of best alternatives with the change of the probability of High demand. Be sure to label each decision alternative accordingly, and mark the region of the probability of High demand such that each decision alternative is the best choice within that region.
8. What is the Expected Value without Perfect Information (EVwoPI)? What is the Expected Value with perfect Information (EVwPI)? What is the Expected Value of Perfect Information (EVPI)?
9. Go back to your Regret or Opportunity Loss Table in item 3 above. Use the  $P(\text{High})=0.9$  and  $P(\text{Low})=0.1$  to find out the Expected Opportunity Loss for each decision alternative and find out the best decision alternative with the decision rule that will minimize expected opportunity loss.
10. Compare your answers in the items 8 and 9 above and comment on your findings.
11. Suppose after the analysis in the item 9 above, PDC considers to undertaking a six-month market research study designed to evaluate market acceptance. Suppose the market research firm will charge PDC \$500,000 to conduct the study, the following conditional probabilities of favorable or unfavorable report given high or low market acceptance are available from past studies by a market research firm that PDC consider to hire again:

Conditional Probability of Favorable or Unfavorable Report given High or Low Market Acceptance		
	High(H)	Low(L)
Favorable (F)	$P(F H)=0.85$	$P(F L) 0.2$
Unfavorable (UF)	$P(UF H) 0.15$	$P(UF L) 0.8$

12. What are the joint probabilities of market acceptance and outcome of a market research report? Please fill your answers in the following table. Include the Excel@ formulas for the computations with Excel@ Formulas/Show Formulas.

Contingency Table with Joint Probabilities			
	High(H)	Low(L)	SumRow
Favorable (F)	$P(H \cap F)=$	$P(L \cap F)=$	
Unfavorable (UF)	$P(H \cap UF)=$	$P(L \cap UF)=$	
SumCol			

13. What are the posterior probabilities? Please fill your answers in the following table. Include the Excel@ formulas for the computations with Excel@ Formulas/Show Formulas.

Posterior Probability of Market Acceptance Given Favorable or Unfavorable Report			
	High(H)	Low(L)	SumRow
Favorable (F)	$P(H F)=$	$P(L F)=$	
Unfavorable (UF)	$P(UF H)=$	$P(UF L)=$	

14. Use Excel@ TreePlan on another worksheet to construct an improved decision tree that incorporates the sample information of the market research as given in the items 11, 12 and 13

above with the same payoff data to find out the Expected Value with Sample Information (EVwSI), and link appropriate values of probabilities, payoffs and names to your decision tree from your previous computations (you do not type in names and values for your Decision Tree). Fold back the tree to determine the optimal strategy and EMV.

15. What is the EVSI or the Expected Value of Sample Information? What should the company do to maximize the expected profit? Provide your computation for EVSI on the same page with your decision tree.
16. What is the Efficiency of Sample Information? Provide managerial interpretation for the efficiency of sample information.
17. Write a brief statement giving the optimal decision strategy and EMV and an interpretation of the EVSI that would be understandable to company management who is not familiar with decision analysis.

(This assignment is from Anderson, Sweeney, Williams, Management Science, 8th Edition, pp.575, with modifications)

Homework 3 Decision Analysis 1 has three problems. It includes Problem 22 on page 792, Problem 24 on page 793 and Case 15.2 on page 797, Ragsdale, 2007. They are reproduced here for convenience.

Decision Analysis 1.1 (Problem 22 on page 792): The Mobile Oil company has recently acquired oil rights to a new potential source of natural oil in Alaska. The current market value of these rights is \$90,000. However, if there is natural oil at the site, it is estimated to be worth \$800,000; however, the company would have to pay \$100,000 in drilling costs to extract the oil. The company believes there is a 0.25 probability that the proposed drilling site actually would hit the natural oil reserve. Alternatively, the company can pay \$30,000 to first carry out a seismic survey at the proposed drilling site. Historically, if the seismic survey produces a favorable result, there is a 0.50 chance of hitting oil at the drilling site. However, if the seismic survey produces an unfavorable result, there is only a 0.14285 probability of hitting oil. The probability of an unfavorable seismic survey when no oil is present is 0.80.

- a. What is the probability of a favorable seismic survey?
- b. What is the probability of an unfavorable seismic survey?
- c. Construct a decision tree for this problem.
- d. What is the optimal decision strategy using the EMV criterion?
- e. To which financial estimate in the decision tree is the EMV most sensitive?

Decision Analysis 1.2 (Problem 24 on page 793): Eagle Credit Union (ECU) has experienced a 10% default rate with its commercial loan customers (i.e. 90% of commercial loan customers pay back their loans). ECU has developed a statistical test to assist in predicting which commercial loan customers will default. The test assigns either a rating of "Approve" or "Reject" to each loan applicant. When applied to recent commercial loan customers who paid their loans, the test gave an "Approve" rating in 80% of the cases examined. When applied to recent commercial loan customers who defaulted, it gave a "Reject" rating in 70% of the cases examined.

- a. Use this data to construct a joint probability table.
- b. What is the conditional probability of a "Reject" rating given that the customer defaulted?
- c. What is the conditional probability of an "Approve" rating given that the customer defaulted?
- d. Suppose a new customer receives a "Reject" rating. If that customer gets the loan anyway, what is the probability of default?

Decision Analysis 1.3 (Case 15.2 on page 797): In the mid-1990s, DHL was the world's largest shipping company, with \$5.7 billion in revenue and 60,000 employees. Larry Hillblom was the "H" in DHL and founder of the company. DHL started on a shoestring budget in 1969 with a business plan to deliver shipping documents by air courier to ports of call days before cargo ships arrived, so that vessels could be unloaded quickly upon arrival and be on their way. The company grew into an international air courier, making Hillblom a millionaire before he turned 30. While not as famous in the U.S. as Federal Express, overseas DHL is so ubiquitous that its name is synonymous with next-day-air shipping in the same manner that the word "Coke" is used to mean "soft drink."

To avoid U.S. income taxes, Hillblom moved from the San Francisco Bay area to Saipan, a tropical tax haven a thousand miles off the southeast coast of Japan. He became a Micronesian kingpin, launching dozens of businesses and financing land development projects in the Philippines, Hawaii, and Vietnam. He owned European castles and hotels, a Chinese jet, an airline called Continental Micronesian and, in addition to his mansion in Saipan, maintained residences in Manila, Hawaii, and Half Moon Bay. His hobbies included high-end stereo equipment, boats, airplanes, fancy cars and, reportedly, illicit relationships with young Asian girls.

On May 21, 1995, Hillblom and two business associates took off for Saipan in Hillblom's twin-engine seaplanes from nearby Pagan Island for a short business trip. Bad weather turned the travelers back and, soon thereafter, dispatchers lost track of the plane. The next morning a search party located parts of the plane and the sodden bodies of Hillblom's companions. Hillblom's body was never found.

Larry Hillblom never married and had no legitimate children. Unfortunately for the Hillblom estate, his will did not contain a clause disinheriting any illegitimate children. Under the prevailing laws, he could have written his children out of the will, but because he didn't, anyone who could prove to be his child would be entitled to an inheritance. Shortly after Hillblom's death, one such child, Larry Junior (age 12), filed suit claiming a share of the estate. (Months after Hillblom's death, several young women emerged from Vietnam, the Philippines, and the Islands of Micronesia claiming that Hillblom had taken up with them briefly and left them with children. See <http://dna-view.com/sfstory.htm> for additional sordid details.)

Several possible impediments stood in the way of Larry Junior's claim to the Hillblom estate. First, Larry Junior and his attorneys must await the outcome of a proposed law (known as the Hillblom Law) written under serious financial pressure from attorneys for the Hillblom estate. If passed by the legislature and signed by the governor, the proposed law would retroactively invalidate the claims of illegitimate heirs not specifically mentioned in a will. Larry Junior's advisers estimate a 0.60 probability of the proposed law passing. If the law passes, Larry Junior's attorneys plan to challenge its constitutionality and assign a 0.7 probability to this challenge being successful.

If the Hillblom Law does not pass (or passes and is later deemed unconstitutional) Larry Junior will still have to present evidence that he is the son of the deceased Larry Hillblom. Such claims of paternity are routinely proven or disproven using DNA matching. However, Hillblom disappeared without leaving a physical trace. (Twelve gallons of muriatic acid were delivered to Hillblom's house shortly after his death, and by the time Larry Junior's attorneys got there, the house was antiseptically clean.) However, during facial reconstruction surgery following another plane crash that Larry Hillblom had been in and survived, a mole was removed from his face. That mole could be used for DNA testing if Larry Junior's attorneys can gain access to it. But the mole is in possession of a medical center that is the primary beneficiary of the estate under the contested will. Without DNA evidence, the case cannot go forward. Larry Junior's attorneys estimate a 0.8 probability of being able to obtain appropriate DNA evidence in one way or another. If they are able to obtain a DNA sample, the attorneys estimate a 0.7 probability of it proving a biological relation between Larry Junior and the decedent.

If DNA proof of Larry Junior's claimed parentage is established, his attorneys believe the Hillblom estate will offer a settlement of approximated \$40 million to avoid going to court. If this

settlement offer is rejected, Larry Junior's legal team faces an uncertain outcome in court. His attorneys believe there is a 0.20 chance that their claim could be dismissed by the court (in which case Larry Junior would receive \$0). However, even if they are successful in court, the amount of the award to Larry Junior would depend on how many other illegitimate children make successful claims against the estate. Larry Junior's advisers estimate a 0.04 probability that he would win \$338 million, a 0.16 probability that he would receive \$68 million, a 0.40 probability that he would receive \$34 million, and a 0.20 probability that he would receive \$17 million.

While vehemently denying that Larry Junior was Mr. Hillblom's son, in early 1996 (and prior to the outcome of the Hillblom Law) the trustees of the Hillblom estate offered Larry Junior a settlement worth approximately \$12 million if he would relinquish all his claims to the Hillblom estate. So Larry Junior and his attorneys face a difficult decision. Do they accept the estate's settlement offer or hope the Hillblom Law doesn't pass and that DNA evidence will establish Larry Junior's rightful claim to the Hillblom estate?

- a. Create a decision tree for this problem.
- b. What decision should Larry Junior make according to the EMV criterion?
- c. What is the minimum settlement offer Larry Junior should accept according to the EMV criterion?
- d. What would you do if you were Larry Junior?
- e. If you were advising Larry Junior, what other issues might you want to consider in making this decision?