

HOMEWORK ON PROBABILITY, PAYOFF TABLES, AND EVENT TREES

1. Can probability be zero? If not, why? If so, when? [Hint: distinguish between outcomes, experiments, and states.]

For a given experiment, the probability of any outcome can be zero (it will never occur). Assuming that all states are covered by the descriptions of the possible outcomes, there must be at least one non zero outcome, however.

2. Some students apply to a variety of colleges that more or less interest them and make a final selection on the basis of the financial aid offer that they receive. In this process, identify the experiment, outcome, and states.

The experiment is the college selection process. The states are the financial aid awards and the outcome is the school selected.

3. The credit department of Lyons Department Store in Anaheim, California, reported that 30 percent of their sales are cash, 30 percent are paid by check at the time of purchase, and 40 percent are charged by credit card. 20 percent of the cash purchases, 90 percent of the checks, and 60 percent of the charges are for more than \$50.00. Ms Stephens just bought a new outfit for \$120. What is the probability that she paid cash?

Construct probability tree to show that out of 100 purchases, 57 will be for over \$50 and, of those, 6 (10.5%) will be paid by cash.

4. Egon Tume recently purchased land near the Gulf of Mexico and is attempting to determine the size of the condominium development that he should put on the land. He is selecting from three standard sizes: small, medium, and large. Uncertain economic conditions make it difficult to determine the demand for the condominiums, however, and the demand will affect his overall profitability. He will lose money, if he builds the large development and demand is low. On the other hand, he will forgo profits, if he builds small and demand is high. He has made the following profit projections (expressed in \$M) for the differing possibilities:

		Demand Levels		
		<u>Low</u>	<u>Medium</u>	<u>High</u>
Condominium Sizes	Small	\$400	\$400	\$400
	Medium	\$100	\$600	\$600
	Large	-\$300	\$300	\$900

- a. What decision should Egon make using Maximax, Maximin, and Minimax Regret strategies (assuming that the three demand levels are all equally likely)?

Maximax: Build large complex (\$900 potential)

Maximin: Build small complex (\$400 potential)

Calculate regret table:

		Demand Levels		
		Low	Medium	High
Condominium Sizes	Small	\$0	\$200	\$500
	Medium	\$300	\$0	\$300
	Large	-\$700	\$300	\$0

Build medium complex. (max. regret is \$300).

- b. What if macroeconomic forecasts calculate that the probability of low demand is .20; medium is .35; and high is .45?

$$E(\text{Small}) = .2(\$400) + .35(\$400) + .45(\$400) = \$400$$

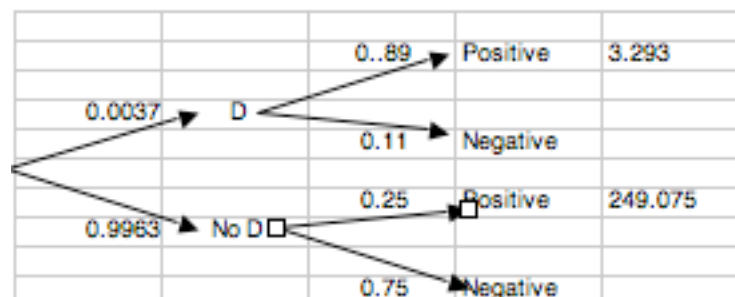
$$E(\text{Medium}) = .2(\$100) + .35(\$600) + .45(\$600) = \$500$$

$$E(\text{Large}) = .2(-300) + .35(300) + .45(900) = \$450$$

Build medium.

5. Use a probability tree to represent the discussion in your text's case, "Amniocentesis, blood tests, and Down's Syndrome." Use this information to verify the claim that 98.7% of the positive test results will be false positives.

Note from text that the test sensitivity is 0.89 and the selectivity is 0.75. The rate of Down's syndrome in women over 35 is 1 in 270 (0.0037). Do calculation for a sample group of 1000 (1000 is arbitrary):



Positive test result with Down's syndrome = $(.0037)(.89)(1000)=3.293$.

*Positive test result when no Down's syndrome =
 $(.9963)(.75)(1000)=249.075$.*

*False positives as a percent of the total positives: $\frac{249.075}{3.293 + 249.075} = 0.98695 \approx$
 98.7%*