



commerce
undergraduate
society

COMMERCE MENTORSHIP PROGRAM

FINAL REVIEW SESSION

COMM 290



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Note: For first-half of course topics and review session recording, please visit [CMP Facebook event page](#).

Disclaimer: CMP and this review session are not operated by or affiliated with the COMM 290 course or its professors. This review session and review package do not serve as a substitute for lectures, labs, and classroom materials.



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Definitions – 2nd Half of Course

Probability Tree – Tree containing all possible outcomes of a probability problem.

Sample Space – All the possible outcomes.

Probability – The chance by which something will happen.

Independent – Knowing something about one outcome does not affect another.

Dependent – Knowing something about one outcome affects another.

Mutually Exclusive – Two outcomes are mutually exclusive if they cannot both occur at the same time.

Expected Monetary Value (EMV) – The expected value of all monetary payoffs

Optimistic Decision Approach – Optimistic approach highlights the best payoff under any decision and selects the decision with the maximum highest payout.

Maximin Conservative Approach – Conservative approach highlights the worst payoff under any decision and selects the decision with the best worst-case payout.

Minimax Regret Approach – Regret approach calculates the difference between each outcome and the best outcome under each state. Then, select the decision that has the least worst- case regret.

Expected Value of Sample Information – The amount of profit gained by knowing another related state before making a decision.

Expected Value of Perfect Information – The amount of profit gained by knowing the state before making a decision.

Efficiency of Information – The % of EVPI extracted using sample information.

Expected Value – The average outcome of a random variable.

Variance – A measurement of how much a variable varies.

Standard Deviation – How much a variable will normally vary relative to the mean.



Probability Trees

Probability Tree – Tree containing all possible outcomes of a probability problem.

Sample Space – All the possible outcomes.

Probability – The chance by which something will happen.

Independent – Knowing something about one outcome does not affect another.

Dependent – Knowing something about one outcome affects another.

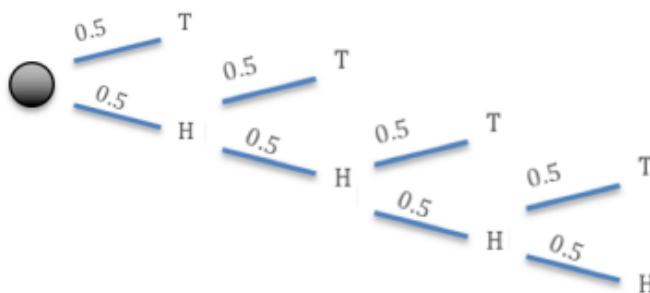
Mutually Exclusive – Two outcomes are mutually exclusive if they cannot both occur at the same time.

=RAND – Generates a random real number between 0 and 1.

Problem – Let's Play a Game: You meet a stranger at a sketchy subway station and agree to play a game. You flip 4 coins – 50% probability of heads. If heads, you get slapped by the stranger. If tails, you win \$1,000. The game ends when you flip tails. Answer the following questions



1. Draw a probability tree for the given scenario. Be sure to include the sample space and probability of each outcome.



Sample Space	Probability
T	0.5
HT	0.25
HHT	0.125
HHHT	0.0625
HHHH	0.0625



Decisions & EMV

Expected Monetary Value (EMV) – The expected value of all monetary payoffs

Optimistic Decision Approach – Optimistic approach highlights the best payoff under any decision and selects the decision with the maximum highest payout.

Maximin Conservative Approach – Conservative approach highlights the worst payoff under any decision and selects the decision with the best worst-case payout.

Minimax Regret Approach – Regret approach calculates the difference between each outcome and the best outcome under each state. Then, select the decision that has the least worst- case regret.

Problem: You are an independent money investor, and you are looking at three options: buying stocks, buying bonds, and shorting stocks. The markets can be down, neutral, or up. The payoff matrix is provided and use it to answer the following questions

	Down (0.2)	Neutral (0.5)	Up (0.3)
Buy Stocks	-20	0	30
Buy Bonds	10	10	10
Short Stocks	30	0	-40

1. Which decision will you make if under the optimistic approach? What about conservative?



2. Construct a regret matrix. Which decision will you make if you are using the regret approach?

	Down (0.2)	Neutral (0.5)	Up (0.3)	Maximum
Buy Stocks	50	10	0	50
Buy Bonds	20	0	20	20
Short Stocks	0	10	70	70

3. Which decision should you make if you are using the EMV (Expected Monetary Value) approach?



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Value of Information

Expected Value of Sample Information – The amount of profit gained by knowing another related state before making a decision.

Expected Value of Perfect Information – The amount of profit gained by knowing the state before making a decision.

Efficiency of Information – The % of EVPI extracted using sample information.

Problem – Makeshift Movie Theatre: You are selling movie tickets for the upcoming Marvel movie. You are unsure whether or not people will like the movie or not: forecasts say there is 0.7 chance that people will like it and 0.3 that they will not. If they like the movie, you will sell tickets for \$10 of profit, and if they don't, you will sell the tickets but at a loss of \$25. If you do not sell in either case, you will be at a loss of \$10.

1. Draw a probability tree; under the EMV approach, what decision will you make?



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2. You can foresee the future at a cost. How much will you be willing to pay in order to foresee the future? Draw the probability tree associated with this scenario.

3. Suppose you can hire a movie expert to improve probability estimates. In the past, the expert predicted audiences were excited for action movies when they liked Marvel movies with a 90% probability. While audiences hated action movies, when they hated Marvel with a 75% chance. Construct a new tree, and find the EVSI (Expected Value of Sample Information).



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Random Variables

Expected Value – The average outcome of a random variable.

Variance – A measurement of how much a variable varies.

Standard Deviation – How much a variable will normally vary relative to the mean

Problem: Consider the following probability distribution and answer the following questions

X	0	1	2	3	4
P(X)	0.3	0.15	0.25	0.2	0.1

1. Find expected value, variance, and standard deviation.
2. Find $P(2 \text{ OR } 3)$ and $P(0 \text{ OR } 2)$.
3. You pick two numbers at random with replacement. Find $P(1\text{st} = 0 \text{ AND } 2\text{nd} = 4)$ and $P(2\text{nd} = 1 \mid 1\text{st} = 4)$.



4. You pick two numbers at random without replacement. Find $P(1\text{st} = 0 \text{ AND } 2\text{nd} = 4)$.

5. Suppose you will take whatever number you pick out, and construct a square with that given number as the side length. What is the expected value, variance, and standard deviation of the area of your square?

Y	0	1	4	9	16
P(Y)	0.3	0.15	0.25	0.2	0.1

6. This question is unrelated to the previous scenario. Given $E(X^2) = 20$ and $E(X) = 5$, find $\text{VAR}(X)$ and $\text{STDEV}(X)$.



Independent Bi-Variable Problem

Problem: Given the following probability distribution for a closed auction, answer the following questions. Assume the two players' strategies are independent.

		Player 1 (A)			
		Bid \$1	Bid \$3	Bid \$5	
Player 2 (B)	Bid \$2	0.1	0.18	0.12	0.4
	Bid \$4	0.1	0.18	0.12	0.4
	Bid \$6	0.05	0.09	0.06	0.2
		0.25	0.45	0.3	

1. What is the probability that Player 1 wins? What is the probability that Player 2 wins?



2. Find the expected value of $(A + (-B))$. What does this mean?

3. Find the expected value, variance, and standard deviation of the following the winning bid



Dependent Bi-variable Problem

Problem: Given the following probability distribution, answer the following questions.

	Y = 0	Y = 1	Y = 2	Total
X = 0	0.1	0.2	0.1	0.4
X = 1	0.15	0.1	0.05	0.3
X = 2	0.05	0.1	0.15	0.3
Total	0.3	0.4	0.3	1.0

1. How can you tell that this probability distribution is dependent (besides that it's given)? Explain.
2. Find $P(X = 2 \mid Y = 1)$.
3. Find $P(X = 1 \text{ AND } Y = 2)$.
4. Find $P(X = 1 \text{ OR } (Y = 1 \text{ OR } 2))$.

