2023 Reading	2023 Learning Objectives	2024 Reading	2024 Learning Objectives	Changes
Topic 1	**FOUNDATIONS OF RISK MANAGEMENT—Part I Exam Weight | 20%**	**Topic 1**	**FOUNDATIONS OF RISK MANAGEMENT—Part I Exam Weight | 20%**	
FRM-1	**Chapter 1. The Building Blocks of Risk Management** • Explain the concept of risk and compare risk management with risk taking. • Evaluate, compare, and apply tools and procedures used to measure and manage risk, including quantitative measures, qualitative risk assessment techniques, and enterprise risk management. • Distinguish between expected loss and unexpected loss, and provide examples of each. • Interpret the relationship between risk and reward and explain how conflicts of interest can impact risk management. • Describe and differentiate between the key classes of risks, explain how each type of risk can arise, and assess the potential impact of each type of risk on an organization. • Explain how risk factors can interact with each other and describe challenges in aggregating risk exposures.	FRM-1	**Chapter 1. The Building Blocks of Risk Management** • Explain the concept of risk and compare risk management with risk taking. • Evaluate, compare, and apply tools and procedures used to measure and manage risk, including quantitative measures, qualitative risk assessment techniques, and enterprise risk management. • Distinguish between expected loss and unexpected loss, and provide examples of each. • Interpret the relationship between risk and reward and explain how conflicts of interest can impact risk management. • Describe and differentiate between the key classes of risks, explain how each type of risk can arise, and assess the potential impact of each type of risk on an organization. • Explain how risk factors can interact with each other and describe challenges in aggregating risk exposures.	No Changes
FRM-2	**Chapter 2. How Do Firms Manage Financial Risk?** • Compare different strategies a firm can use to manage its risk exposures and explain situations in which a firm would want to use each strategy. • Explain the relationship between risk appetite and a firm's risk management decisions. • Evaluate some advantages and disadvantages of hedging risk exposures, and explain challenges that can arise when implementing a hedging strategy. • Apply appropriate methods to hedge operational and financial risks, including pricing, foreign currency, and interest rate risk. • Assess the impact of risk management tools and instruments, including risk limits and derivatives.	FRM-2	**Chapter 2. How Do Firms Manage Financial Risk?** • Compare different strategies a firm can use to manage its risk exposures and explain situations in which a firm would want to use each strategy. • Explain the relationship between risk appetite and a firm's risk management decisions. • Evaluate some advantages and disadvantages of hedging risk exposures, and explain challenges that can arise when implementing a hedging strategy. • Apply appropriate methods to hedge operational and financial risks, including pricing, foreign currency, and interest rate risk. • Assess the impact of risk management tools and instruments, including risk limits and derivatives.	No Changes
FRM-3	**Chapter 3. The Governance of Risk Management** • Explain changes in corporate risk governance that occurred as a result of the 2007 - 2009 financial crisis. • Describe best practices for the governance of a firm's risk management processes. • Explain the risk management role and responsibilities of a firm's board of directors. • Evaluate the relationship between a firm's risk appetite and its business strategy, including the role of incentives. • Illustrate the interdependence of functional units within a firm as it relates to risk management. • Assess the role and responsibilities of a firm's audit committee.	FRM-3	**Chapter 3. The Governance of Risk Management** • Explain changes in corporate risk governance that occurred as a result of the 2007 - 2009 financial crisis. • Describe best practices for the governance of a firm's risk management processes. • Explain the risk management role and responsibilities of a firm's board of directors. • Evaluate the relationship between a firm's risk appetite and its business strategy, including the role of incentives. • Illustrate the interdependence of functional units within a firm as it relates to risk management. • Assess the role and responsibilities of a firm's audit committee.	No Changes
FRM-4	**Chapter 4. Credit Risk Transfer Mechanisms** • Compare different types of credit derivatives, explain their applications, and describe their advantages. • Explain different traditional approaches or mechanisms that firms can use to help mitigate credit risk. • Evaluate the role of credit derivatives in the 2007 - 2009 financial crisis, and explain changes in the credit derivative market that occurred as a result of the crisis. • Explain the process of securitization, describe a special purpose vehicle (SPV), and assess the risk of different business models that banks can use for securitized products.	FRM-4	**Chapter 4. Credit Risk Transfer Mechanisms** • Compare different types of credit derivatives, explain their applications, and describe their advantages. • Explain different traditional approaches or mechanisms that firms can use to help mitigate credit risk. • Evaluate the role of credit derivatives in the 2007 - 2009 financial crisis, and explain changes in the credit derivative market that occurred as a result of the crisis. • Explain the process of securitization, describe a special purpose vehicle (SPV), and assess the risk of different business models that banks can use for securitized products.	No Changes
FRM-5	**Chapter 5. Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM)** • Explain modern portfolio theory and interpret the Markowitz efficient frontier. • Understand the derivation and components of the CAPM. • Describe the assumptions underlying the CAPM. • Interpret and compare the capital market line and the security market line. • Apply the CAPM in calculating the expected return on an asset. • Interpret beta and calculate the beta of a single asset or portfolio. • Calculate, compare, and interpret the following performance measures: the Sharpe performance index, the Treynor performance index, the Jensen performance index, the tracking error, information ratio, and Sortino ratio.	FRM-5	**Chapter 5. Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM)** • Explain modern portfolio theory and interpret the Markowitz efficient frontier. • Understand the derivation and components of the CAPM. • Describe the assumptions underlying the CAPM. • Interpret and compare the capital market line and the security market line. • Apply the CAPM in calculating the expected return on an asset. • Interpret beta and calculate the beta of a single asset or portfolio. • Calculate, compare, and interpret the following performance measures: the Sharpe performance index, the Treynor performance index, the Jensen performance index, the tracking error, information ratio, and Sortino ratio.	No Changes
FRM-6	**Chapter 6. The Arbitrage Pricing Theory and Multifactor Models of Risk and Return** • Explain the arbitrage pricing theory (APT), describe its assumptions, and compare the APT to the CAPM. • Describe the inputs (including factor betas) to a multifactor model and explain the challenges of using multifactor models in hedging. • Calculate the expected return of an asset using a single-factor and a multifactor model. • Explain how to construct a portfolio to hedge exposure to multiple factors. • Describe and apply the Fama-French three factor model in estimating asset returns.	FRM-6	**Chapter 6. The Arbitrage Pricing Theory and Multifactor Models of Risk and Return** • Explain the arbitrage pricing theory (APT), describe its assumptions, and compare the APT to the CAPM. • Describe the inputs (including factor betas) to a multifactor model and explain the challenges of using multifactor models in hedging. • Calculate the expected return of an asset using a single-factor and a multifactor model. • Explain how to construct a portfolio to hedge exposure to multiple factors. • Describe and apply the Fama-French three factor model in estimating asset returns.	No Changes
FRM-7	**Chapter 7. Principles for Effective Data Aggregation and Risk Reporting** • Explain the potential benefits of having effective risk data aggregation and reporting. • Explain challenges to the implementation of a strong risk data aggregation and reporting process and the potential impacts of using poor quality data. • Describe key governance principles related to risk data aggregation and risk reporting practices. • Describe characteristics of effective data architecture, IT infrastructure, and risk reporting practices.	FRM-7	**Chapter 7. Principles for Effective Data Aggregation and Risk Reporting** • Explain the potential benefits of having effective risk data aggregation and reporting. • Explain challenges to the implementation of a strong risk data aggregation and reporting process and the potential impacts of using poor quality data. • Describe key governance principles related to risk data aggregation and risk reporting practices. • Describe characteristics of effective data architecture, IT infrastructure, and risk reporting practices.	No Changes
FRM-8	**Chapter 8. Enterprise Risk Management and Future Trends** • Describe Enterprise Risk Management (ERM) and compare an ERM program with a traditional silo-based risk management program. • Describe the motivations for a firm to adopt an ERM initiative. • Explain best practices for the governance and implementation of an ERM program. • Describe risk culture, explain characteristics of a strong corporate risk culture, and describe challenges to the establishment of a strong risk culture at a firm. • Explain the role of scenario analysis in the implementation of an ERM program and describe its advantages and disadvantages. • Explain the use of scenario analysis in stress testing programs and in capital planning.	FRM-8	**Chapter 8. Enterprise Risk Management and Future Trends** • Describe Enterprise Risk Management (ERM) and compare an ERM program with a traditional silo-based risk management program. • Describe the motivations for a firm to adopt an ERM initiative. • Explain best practices for the governance and implementation of an ERM program. • Describe risk culture, explain characteristics of a strong corporate risk culture, and describe challenges to the establishment of a strong risk culture at a firm. • Explain the role of scenario analysis in the implementation of an ERM program and describe its advantages and disadvantages. • Explain the use of scenario analysis in stress testing programs and in capital planning.	No Changes

FRM-9	**Chapter 9. Learning From Financial Disasters**
	• Analyze the key factors that led to and derive the lessons learned from case studies involving the following risk factors:
	  • Interest rate risk, including the 1980s savings and loan crisis in the US
	  • Funding liquidity risk, including Lehman Brothers, Continental Illinois, and Northern Rock
	  • Implementing hedging strategies, including the Metallgesellschaft case
	  • Model risk, including the Niederhoffer case, Long Term Capital Management, and the London Whale case
	  • Rogue trading and misleading reporting, including the Barings case
	  • Financial engineering and complex derivatives, including Bankers Trust, the Orange County case, and Sachsen Landesbank
	  • Reputational risk, including the Volkswagen case
	  • Corporate governance, including the Enron case
	  • Cyber risk, including the SWIFT case
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			  • Implementing hedging strategies, including the Metallgesellschaft case
			  • Model risk, including the Niederhoffer case, Long Term Capital Management, and the London Whale case
			  • Rogue trading and misleading reporting, including the Barings case
			  • Financial engineering and complex derivatives, including Bankers Trust, the Orange County case, and Sachsen Landesbank
			  • Reputational risk, including the Volkswagen case
			  • Corporate governance, including the Enron case
			  • Cyber risk, including the SWIFT case
				No Changes

FRM-10	**Chapter 10. Anatomy of the Great Financial Crisis of 2007-2009** • Describe the historical background and provide an overview of the 2007 - 2009 financial crisis. • Describe the build-up to the financial crisis and the factors that played an important role. • Explain the role of subprime mortgages and collateralized debt obligations (CDOs) in the crisis. • Compare the roles of different types of institutions in the financial crisis, including banks, financial intermediaries, mortgage brokers and lenders, and rating agencies. • Describe trends in the short-term wholesale funding markets that contributed to the financial crisis, including their impact on systemic risk. • Describe responses taken by central banks in response to the crisis.	FRM-10	**Chapter 10. Anatomy of the Great Financial Crisis of 2007-2009** • Describe the historical background and provide an overview of the 2007 - 2009 financial crisis. • Describe the build-up to the financial crisis and the factors that played an important role. • Explain the role of subprime mortgages and collateralized debt obligations (CDOs) in the crisis. • Compare the roles of different types of institutions in the financial crisis, including banks, financial intermediaries, mortgage brokers and lenders, and rating agencies. • Describe trends in the short-term wholesale funding markets that contributed to the financial crisis, including their impact on systemic risk. • Describe responses taken by central banks in response to the crisis.	No Changes
FRM-11	**Chapter 11. GARP Code of Conduct.** • Describe the responsibility of each GARP Member with respect to professional integrity, ethical conduct, conflicts of interest, confidentiality of information, and adherence to generally accepted practices in risk management. • Describe the potential consequences of violating the GARP Code of Conduct.	FRM-11	**Chapter 11. GARP Code of Conduct.** • Describe the responsibility of each GARP Member with respect to professional integrity, ethical conduct, conflicts of interest, confidentiality of information, and adherence to generally accepted practices in risk management. • Describe the potential consequences of violating the GARP Code of Conduct.	No Changes
Topic 2	**QUANTITATIVE ANALYSIS—Part I Exam Weight | 20%**	**Topic 2**	**QUANTITATIVE ANALYSIS—Part I Exam Weight | 20%**	

QA-1 **Chapter 1: Fundamentals of Probability**

- Describe an event and an event space.
- Describe independent events and mutually exclusive events.
- Explain the difference between independent events and conditionally independent events.
- Calculate the probability of an event for a discrete probability function.
- Define and calculate a conditional probability.
- Distinguish between conditional and unconditional probabilities.
- Explain and apply Bayes' rule.

QA-2 **Chapter 2: Random Variables**

- Describe and distinguish a probability mass function from a cumulative distribution function, and explain the relationship between these two.
- Understand and apply the concept of a mathematical expectation of a random variable.
- Describe the four common population moments.
- Explain the differences between a probability mass function and a probability density function.
- Characterize the quantile function and quantile-based estimators.
- Explain the effect of a linear transformation of a random variable on the mean, variance, standard deviation, skewness, kurtosis, median, and interquartile range.

QA-3 **Chapter 3: Common Univariate Random Variables**

- Distinguish the key properties and identify the common occurrences of the following distributions: uniform distribution, Bernoulli distribution, binomial distribution, Poisson distribution, normal distribution, lognormal distribution, Chi-squared distribution, Student's t, and F-distributions.
- Describe a mixture distribution and explain the creation and characteristics of mixture distributions.

QA-4 **Chapter 4: Multivariate Random Variables**

- Explain how a probability matrix can be used to express a probability mass function (PMF)
- Compute the marginal and conditional distributions of a discrete bivariate random variable.
- Explain how the expectation of a function is computed for a bivariate discrete random variable.
- Define covariance and explain what it measures.
- Explain the relationship between the covariance and correlation of two random variables, and how these are related to the independence of the two variables.
- Explain the effects of applying linear transformations on the covariance and correlation between two random variables.
- Compute the variance of a weighted sum of two random variables.
- Compute the conditional expectation of a component of a bivariate random variable.
- Describe the features of an independent and identically distributed (iid) sequence of random variables.
- Explain how the iid property is helpful in computing the mean and variance of a sum of iid random variables.

QA-5 **Chapter 5: Sample Moments**

- Estimate the mean, variance, and standard deviation using sample data.
- Explain the difference between a population moment and a sample moment.
- Distinguish between an estimator and an estimate.
- Describe the bias of an estimator and explain what the bias measures.
- Explain what is meant by the statement that the mean estimator is BLUE.
- Describe the consistency of an estimator and explain the usefulness of this concept.
- Explain how the Law of Large Numbers (LLN) and Central Limit Theorem (CLT) apply to the sample mean.
- Estimate and interpret the skewness and kurtosis of a random variable.
- Use sample data to estimate quantiles, including the median.
- Estimate the mean of two variables and apply the CLT .
- Estimate the covariance and correlation between two random variables.
- Explain how coskewness and cokurtosis are related to skewness and kurtosis.

QA-6 **Chapter 6: Hypothesis Testing**

- Construct an appropriate null hypothesis and alternative hypothesis and distinguish between the two.
- Differentiate between a one-sided and a two-sided test and identify when to use each test.
- Explain the difference between Type I and Type II errors and how these relate to the size and power of a test.
- Understand how a hypothesis test and a confidence interval are related.
- Explain what the p-value of a hypothesis test measures.
- Construct and apply confidence intervals for one-sided and two-sided hypothesis tests, and interpret the results of hypothesis tests with a specific level of confidence.
- Identify the steps to test a hypothesis about the difference between two population means.
- Explain the problem of multiple testing and how it can bias results.

QA-7 **Chapter 7: Linear Regression**

- Describe the models that can be estimated using linear regression and differentiate them from those which cannot.
- Interpret the results of an ordinary least squares (OLS) regression with a single explanatory variable.
- Describe the key assumptions of OLS parameter estimation.
- Characterize the properties of OLS estimators and their sampling distributions.
- Construct, apply, and interpret hypothesis tests and confidence intervals for a single regression coefficient in a regression.
- Explain the steps needed to perform a hypothesis test in a linear regression.
- Describe the relationship between a t-statistic, it's p-value, and a confidence interval.
- **Estimate the correlation coefficient from the R2 measure obtained in linear regressions with a single explanatory variable.**

QA-8 **Chapter 8: Regression with Multiple Explanatory Variables**

- Distinguish between the relative assumptions of single and multiple regression.
- Interpret regression coefficients in a multiple regression.
- Interpret goodness of fit measures for single and multiple regressions, including R2 and adjusted-R2.
- Construct, apply, and interpret joint hypothesis tests and confidence intervals for multiple coefficients in a regression.
- **Calculate the regression R2 using the three components of the decomposed variation of the dependent variable data: the explained sum of squares, the total sum of squares, and the residual sum of squares.**

QA-9 **Chapter 9: Regression Diagnostics**

- Explain how to test whether a regression is affected by heteroskedasticity.
- Describe approaches to using heteroskedastic data.
- Characterize multicollinearity and its consequences; distinguish between multicollinearity and perfect collinearity.
- Describe the consequences of excluding a relevant explanatory variable from a model and contrast those with the consequences of including an irrelevant regressor.
- Explain two model selection procedures and how these relate to the bias-variance trade-off.
- Describe the various methods of visualizing residuals and their relative strengths.
- Describe methods for identifying outliers and their impact.
- Determine the conditions under which OLS is the best linear unbiased estimator.

QA-10 **Chapter 10: Stationary Time Series**

- Describe the requirements for a series to be covariance stationary.
- Define the autocovariance function and the autocorrelation function(ACF).
- Define white noise, describe independent white noise and normal (Gaussian) white noise.
- Define and describe the properties of autoregressive (AR) processes.
- Define and describe the properties of moving average (MA) processes.
- Explain how a lag operator works.

QA-1 **Chapter 1: Fundamentals of Probability** — **No Changes**

- Describe an event and an event space.
- Describe independent events and mutually exclusive events.
- Explain the difference between independent events and conditionally independent events.
- Calculate the probability of an event for a discrete probability function.
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QA-2 **Chapter 2: Random Variables** — **No Changes**

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- Explain the effect of a linear transformation of a random variable on the mean, variance, standard deviation, skewness, kurtosis, median, and interquartile range.

QA-3 **Chapter 3: Common Univariate Random Variables** — **No Changes**

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- Describe a mixture distribution and explain the creation and characteristics of mixture distributions.

QA-4 **Chapter 4: Multivariate Random Variables** — **No Changes**

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- Explain the effects of applying linear transformations on the covariance and correlation between two random variables.
- Compute the variance of a weighted sum of two random variables.
- Compute the conditional expectation of a component of a bivariate random variable.
- Describe the features of an independent and identically distributed (iid) sequence of random variables.
- Explain how the iid property is helpful in computing the mean and variance of a sum of iid random variables.

QA-5 **Chapter 5: Sample Moments** — **No Changes**

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- Distinguish between an estimator and an estimate.
- Describe the bias of an estimator and explain what the bias measures.
- Explain what is meant by the statement that the mean estimator is BLUE.
- Describe the consistency of an estimator and explain the usefulness of this concept.
- Explain how the Law of Large Numbers (LLN) and Central Limit Theorem (CLT) apply to the sample mean.
- Estimate and interpret the skewness and kurtosis of a random variable.
- Use sample data to estimate quantiles, including the median.
- Estimate the mean of two variables and apply the CLT .
- Estimate the covariance and correlation between two random variables.
- Explain how coskewness and cokurtosis are related to skewness and kurtosis.

QA-6 **Chapter 6: Hypothesis Testing** — **No Changes**

- Construct an appropriate null hypothesis and alternative hypothesis and distinguish between the two.
- Differentiate between a one-sided and a two-sided test and identify when to use each test.
- Explain the difference between Type I and Type II errors and how these relate to the size and power of a test.
- Understand how a hypothesis test and a confidence interval are related.
- Explain what the p-value of a hypothesis test measures.
- Construct and apply confidence intervals for one-sided and two-sided hypothesis tests, and interpret the results of hypothesis tests with a specific level of confidence.
- Identify the steps to test a hypothesis about the difference between two population means.
- Explain the problem of multiple testing and how it can bias results.

QA-7 **Chapter 7: Linear Regression** — **No Changes**

- Describe the models that can be estimated using linear regression and differentiate them from those which cannot.
- Interpret the results of an ordinary least squares (OLS) regression with a single explanatory variable.
- Describe the key assumptions of OLS parameter estimation.
- Characterize the properties of OLS estimators and their sampling distributions.
- Construct, apply, and interpret hypothesis tests and confidence intervals for a single regression coefficient in a regression.
- Explain the steps needed to perform a hypothesis test in a linear regression.
- Describe the relationship between a t-statistic, it's p-value, and a confidence interval.
- Estimate the correlation coefficient from the R2 measure obtained in linear regressions with a single explanatory variable.

QA-8 **Chapter 8: Regression with Multiple Explanatory Variables** — **No Changes**

- Distinguish between the relative assumptions of single and multiple regression.
- Interpret regression coefficients in a multiple regression.
- Interpret goodness of fit measures for single and multiple regressions, including R2 and adjusted-R2.
- Construct, apply, and interpret joint hypothesis tests and confidence intervals for multiple coefficients in a regression.
- Calculate the regression R2 using the three components of the decomposed variation of the dependent variable data: the explained sum of squares, the total sum of squares, and the residual sum of squares.

QA-9 **Chapter 9: Regression Diagnostics** — **No Changes**

- Explain how to test whether a regression is affected by heteroskedasticity.
- Describe approaches to using heteroskedastic data.
- Characterize multicollinearity and its consequences; distinguish between multicollinearity and perfect collinearity.
- Describe the consequences of excluding a relevant explanatory variable from a model and contrast those with the consequences of including an irrelevant regressor.
- Explain two model selection procedures and how these relate to the bias-variance trade-off.
- Describe the various methods of visualizing residuals and their relative strengths.
- Describe methods for identifying outliers and their impact.
- Determine the conditions under which OLS is the best linear unbiased estimator.

QA-10 **Chapter 10: Stationary Time Series** — **No Changes**

- Describe the requirements for a series to be covariance stationary.
- Define the autocovariance function and the autocorrelation function(ACF).
- Define white noise, describe independent white noise and normal (Gaussian) white noise.
- Define and describe the properties of autoregressive (AR) processes.
- Define and describe the properties of moving average (MA) processes.
- Explain how a lag operator works.

	• Explain mean reversion and calculate a mean-reverting level. • Define and describe the properties of autoregressive moving average (ARMA) processes. • Describe the application of AR, MA, and ARMA processes. • Describe sample autocorrelation and partial autocorrelation. • Describe the Box-Pierce Q-statistic and the Ljung-Box Q statistic. • Explain how forecasts are generated from ARMA models. • Describe the role of mean reversion in long-horizon forecasts. • Explain how seasonality is modeled in a covariance-stationary ARMA.		• Explain mean reversion and calculate a mean-reverting level. • Define and describe the properties of autoregressive moving average (ARMA) processes. • Describe the application of AR, MA, and ARMA processes. • Describe sample autocorrelation and partial autocorrelation. • Describe the Box-Pierce Q-statistic and the Ljung-Box Q statistic. • Explain how forecasts are generated from ARMA models. • Describe the role of mean reversion in long-horizon forecasts. • Explain how seasonality is modeled in a covariance-stationary ARMA.	
QA-11	**Chapter 11: Nonstationary Time Series** • Describe linear and nonlinear time trends. • Explain how to use regression analysis to model seasonality. • Describe a random walk and a unit root. • Explain the challenges of modeling time series containing unit roots. • Describe how to test if a time series contains a unit root. • Explain how to construct an h-step-ahead point forecast for a time series with seasonality. • Calculate the estimated trend value and form an interval forecast for a time series.	**QA-11**	**Chapter 11: Nonstationary Time Series** • Describe linear and nonlinear time trends. • Explain how to use regression analysis to model seasonality. • Describe a random walk and a unit root. • Explain the challenges of modeling time series containing unit roots. • Describe how to test if a time series contains a unit root. • Explain how to construct an h-step-ahead point forecast for a time series with seasonality. • Calculate the estimated trend value and form an interval forecast for a time series.	**No Changes**
QA-12	**Chapter 12: Measuring Return, Volatility, and Correlation** • Calculate, distinguish, and convert between simple and continuously compounded returns. • Define and distinguish between volatility, variance rate, and implied volatility. • Describe how the first two moments may be insufficient to describe non-normal distributions. • Explain how the Jarque-Bera test is used to determine whether returns are normally distributed. • Describe the power law and its use for non-normal distributions. • Define correlation and covariance and differentiate between correlation and dependence. • Describe properties of correlations between normally distributed variables when using a one-factor model. • **Compare and contrast the different measures of correlation used to assess dependence.**	**QA-12**	**Chapter 12: Measuring Return, Volatility, and Correlation** • Calculate, distinguish, and convert between simple and continuously compounded returns. • Define and distinguish between volatility, variance rate, and implied volatility. • Describe how the first two moments may be insufficient to describe non-normal distributions. • Explain how the Jarque-Bera test is used to determine whether returns are normally distributed. • Describe the power law and its use for non-normal distributions. • Define correlation and covariance and differentiate between correlation and dependence. • Describe properties of correlations between normally distributed variables when using a one-factor model. • Compare and contrast the different measures of correlation used to assess dependence.	**No Changes**
QA-13	**Chapter 13: Simulation and Bootstrapping** • Describe the basic steps to conduct a Monte Carlo simulation. • Describe ways to reduce Monte Carlo sampling error. • Explain the use of antithetic and control variates in reducing Monte Carlo sampling error. • Describe the bootstrapping method and its advantage over Monte Carlo simulation. • Describe pseudo-random number generation • Describe situations where the bootstrapping method is ineffective. • Describe the disadvantages of the simulation approach to financial problem solving.	**QA-13**	**Chapter 13: Simulation and Bootstrapping** • Describe the basic steps to conduct a Monte Carlo simulation. • Describe ways to reduce Monte Carlo sampling error. • Explain the use of antithetic and control variates in reducing Monte Carlo sampling error. • Describe the bootstrapping method and its advantage over Monte Carlo simulation. • Describe pseudo-random number generation • Describe situations where the bootstrapping method is ineffective. • Describe the disadvantages of the simulation approach to financial problem solving.	**No Changes**
QA-14	**Chapter 14: Machine-Learning Methods** • Discuss the philosophical and practical differences between machine-learning techniques and classical econometrics. • Explain the differences among the training, validation, and test data sub-samples, and how each is used. • Understand the differences between and consequences of underfitting and overfitting, and propose potential remedies for each. • Use principal components analysis to reduce the dimensionality of a set of features. • Describe how the K-means algorithm separates a sample into clusters. • Be aware of natural language processing and how it is used. • Differentiate among unsupervised, supervised, and reinforcement learning models. • Explain how reinforcement learning operates and how it is used in decision-making.	**QA-14**	**Chapter 14: Machine-Learning Methods** • Discuss the philosophical and practical differences between machine-learning techniques and classical econometrics. • **Compare and apply the two methods utilized for rescaling variables in data preparation.** • Explain the differences among the training, validation, and test data sub-samples, and how each is used. • Understand the differences between and consequences of underfitting and overfitting, and propose potential remedies for each. • Use principal components analysis to reduce the dimensionality of a set of features. • Describe how the K-means algorithm separates a sample into clusters. • Be aware of natural language processing and how it is used. • Differentiate among unsupervised, supervised, and reinforcement learning models. • Explain how reinforcement learning operates and how it is used in decision-making.	**New LO**
QA-15	**Chapter 15: Machine Learning and Prediction** • Explain the role of linear regression and logistic regression in prediction. • Understand how to encode categorical variables. • Discuss why regularization is useful, and distinguish between the ridge regression and LASSO approaches. • Show how a decision tree is constructed and interpreted. • Describe how ensembles of learners are built. • Outline the intuition behind the K nearest neighbors and support vector machine methods for classification. • Understand how neural networks are constructed and how their weights are determined. • Evaluate the predictive performance of logistic regression models and neural network models using a confusion matrix.	**QA-15**	**Chapter 15: Machine Learning and Prediction** • Explain the role of linear regression and logistic regression in prediction. • **Evaluate the predictive performance of logistic regression models.** • Understand how to encode categorical variables. • Discuss why regularization is useful, and distinguish between the ridge regression and LASSO approaches. • Show how a decision tree is constructed and interpreted. • Describe how ensembles of learners are built. • **Explain** the intuition behind the K nearest neighbors and support vector machine methods for classification. • Understand how neural networks are constructed and how their weights are determined. • **Compare the logistic regression and neural network classification approaches using a confusion matrix**	**New LO** **Wording change (same concept)** **Wording changed (same concept)**
Topic 3	**FINANCIAL MARKETS AND PRODUCTS—Part I Exam Weight | 30%**	**Topic 3**	**FINANCIAL MARKETS AND PRODUCTS—Part I Exam Weight | 30%**	
FMP-1	**Chapter 1. Banks** • Identify the major risks faced by a bank, and explain ways in which these risks can arise. • Distinguish between economic capital and regulatory capital. • Summarize Basel Committee regulations for regulatory capital and their motivations. • Explain how deposit insurance gives rise to a moral hazard problem. • Describe investment banking financing arrangements including private placement, public offering, best efforts, firm commitment, and Dutch auction approaches. • Describe the potential conflicts of interest among commercial banking, securities services, and investment banking divisions of a bank and recommend solutions to the conflict of interest problems. • Describe the distinctions between the "banking book" and the "trading book" of a bank. • Explain the originate-to-distribute model of a bank and discuss its benefits and drawbacks.	**FMP-1**	**Chapter 1. Banks** • Identify the major risks faced by a bank, and explain ways in which these risks can arise. • Distinguish between economic capital and regulatory capital. • Summarize Basel Committee regulations for regulatory capital and their motivations. • Explain how deposit insurance gives rise to a moral hazard problem. • Describe investment banking financing arrangements including private placement, public offering, best efforts, firm commitment, and Dutch auction approaches. • Describe the potential conflicts of interest among commercial banking, securities services, and investment banking divisions of a bank and recommend solutions to the conflict of interest problems. • Describe the distinctions between the "banking book" and the "trading book" of a bank. • Explain the originate-to-distribute model of a bank and discuss its benefits and drawbacks.	**No Changes**
FMP-2	**Chapter 2. Insurance Companies and Pension Plans** • Describe the key features of the various categories of insurance companies and identify the risks facing insurance companies. • Describe the use of mortality tables and calculate the premium payment for a policy holder. • Distinguish between mortality risk and longevity risk and describe how to hedge these risks • Describe a defined benefit plan and a defined contribution plan for a pension fund and explain the differences between them. • Compare the various types of life insurance policies • Calculate and interpret loss ratio, expense ratio, combined ratio, and operating ratio for a property-casualty insurance company. • Describe moral hazard and adverse selection risks facing insurance companies, provide examples of each, and describe how to overcome the problems. • Evaluate the capital requirements for life insurance and property-casualty insurance companies. • Compare the guaranty system and the regulatory requirements for insurance companies with those for banks.	**FMP-2**	**Chapter 2. Insurance Companies and Pension Plans** • Describe the key features of the various categories of insurance companies and identify the risks facing insurance companies. • Describe the use of mortality tables and calculate the premium payment for a policy holder. • Distinguish between mortality risk and longevity risk and describe how to hedge these risks • Describe a defined benefit plan and a defined contribution plan for a pension fund and explain the differences between them. • Compare the various types of life insurance policies • Calculate and interpret loss ratio, expense ratio, combined ratio, and operating ratio for a property-casualty insurance company. • Describe moral hazard and adverse selection risks facing insurance companies, provide examples of each, and describe how to overcome the problems. • Evaluate the capital requirements for life insurance and property-casualty insurance companies. • Compare the guaranty system and the regulatory requirements for insurance companies with those for banks.	**No Changes**
FMP-3	**Chapter 3. Fund Management** • Differentiate among open-end mutual funds, closed-end mutual funds, and exchange-traded funds (ETFs). • Identify and describe potential undesirable trading behaviors at mutual funds. • **Explain the concept of net asset value (NAV) of an open-end mutual fund and how it relates to share price.** • Explain the key differences between hedge funds and mutual funds. • Calculate the return on a hedge fund investment and explain the incentive fee structure of a hedge fund including the terms hurdle rate, high-water mark, and clawback. • Describe various hedge fund strategies, including long/short equity, dedicated short, distressed securities, merger arbitrage, convertible arbitrage, fixed income arbitrage, emerging markets, global macro, and managed futures, and identify the risks faced by hedge funds. • Describe characteristics of mutual fund and hedge fund performance and explain the effect of measurement biases on performance measurement.	**FMP-3**	**Chapter 3. Fund Management** • Differentiate among open-end mutual funds, closed-end mutual funds, and exchange-traded funds (ETFs). • Identify and describe potential undesirable trading behaviors at mutual funds. • Explain the concept of net asset value (NAV) of an open-end mutual fund and how it relates to share price. • Explain the key differences between hedge funds and mutual funds. • Calculate the return on a hedge fund investment and explain the incentive fee structure of a hedge fund including the terms hurdle rate, high-water mark, and clawback. • Describe various hedge fund strategies, including long/short equity, dedicated short, distressed securities, merger arbitrage, convertible arbitrage, fixed income arbitrage, emerging markets, global macro, and managed futures, and identify the risks faced by hedge funds. • Describe characteristics of mutual fund and hedge fund performance and explain the effect of measurement biases on performance measurement.	**No Changes**
FMP-4	**Chapter 4. Introduction to Derivatives**	**FMP-4**	**Chapter 4. Introduction to Derivatives**	**No Changes**

	• Define derivatives, describe features and uses of derivatives, and compare linear and non-linear derivatives. • Describe the specifics of exchange-traded and the over-the-counter markets, and evaluate the advantages and disadvantages of each • Differentiate between options, forwards, and futures contracts. • Identify and calculate option and forward contract payoffs. • Differentiate among the broad categories of traders: hedgers, speculators, and arbitrageurs. • Calculate and compare the payoffs from hedging strategies involving forward contracts and options. • Calculate and compare the payoffs from speculative strategies involving futures and options. • Describe arbitrageurs' strategy and calculate an arbitrage payoff • Describe some of the risks that can arise from the use of derivatives.		• Define derivatives, describe features and uses of derivatives, and compare linear and non-linear derivatives. • Describe the specifics of exchange-traded and the over-the-counter markets, and evaluate the advantages and disadvantages of each • Differentiate between options, forwards, and futures contracts. • Identify and calculate option and forward contract payoffs. • Differentiate among the broad categories of traders: hedgers, speculators, and arbitrageurs. • Calculate and compare the payoffs from hedging strategies involving forward contracts and options. • Calculate and compare the payoffs from speculative strategies involving futures and options. • Describe arbitrageurs' strategy and calculate an arbitrage payoff • Describe some of the risks that can arise from the use of derivatives.	
FMP-5	**Chapter 5. Exchanges and OTC Markets** • Describe how exchanges can be used to alleviate counterparty risk. • Explain the developments in clearing that reduce risk. • Describe netting and describe a netting process. • Describe the implementation of a margining process **by CCP** and explain the determinants of and calculate initial and variation margin requirements. • **Describe process of buying stock on margin without using CCP and calculate margin requirements.** • Compare exchange-traded and OTC markets and describe their uses. • Identify risks associated with OTC markets and explain how these risks can be mitigated. • Describe the role of collateralization in the over-the-counter market and compare it to the margining system. • Explain the use of special purpose vehicles (SPVs) in the OTC derivatives market.	**FMP-5**	**Chapter 5. Exchanges and OTC Markets** • Describe how exchanges can be used to alleviate counterparty risk. • Explain the developments in clearing that reduce risk. • Describe netting and describe a netting process. • Describe the implementation of a margining process and explain the determinants of and calculate initial and variation margin requirements. • Describe process of buying stock on margin without using CCP and calculate margin requirements. • Compare exchange-traded and OTC markets and describe their uses. • Identify risks associated with OTC markets and explain how these risks can be mitigated. • Describe the role of collateralization in the over-the-counter market and compare it to the margining system. • Explain the use of special purpose vehicles (SPVs) in the OTC derivatives market.	**NO Changes**
FMP-6	**Chapter 6. Central Clearing** • Provide examples of the mechanics of a central counterparty (CCP). • Describe the role of CCPs and distinguish between bilateral and centralized clearing. • Describe advantages and disadvantages of central clearing of OTC derivatives. • Explain regulatory initiatives for the OTC derivatives market and their impact on central clearing. • Compare margin requirements in centrally cleared and bilateral markets, and explain how margin can mitigate risk. • **Compare netting in bilateral markets vs centrally cleared.** • Assess the impact of central clearing on the broader financial markets. • Identify and explain the types of risks faced by CCPs. • Identify and distinguish between the risks to clearing members as well as non-members.	**FMP-6**	**Chapter 6. Central Clearing** • Provide examples of the mechanics of a central counterparty (CCP). • Describe the role of CCPs and distinguish between bilateral and centralized clearing. • Describe advantages and disadvantages of central clearing of OTC derivatives. • Explain regulatory initiatives for the OTC derivatives market and their impact on central clearing. • Compare margin requirements in centrally cleared and bilateral markets, and explain how margin can mitigate risk. • Compare netting in bilateral markets vs centrally cleared. • Assess the impact of central clearing on the broader financial markets. • Identify and explain the types of risks faced by CCPs. • Identify and distinguish between the risks to clearing members as well as non-members.	**No Changes**
FMP-7	**Chapter 7. Futures Markets** • Define and describe the key features of a futures contract, including the underlying asset, the contract price and size, trading volume, open interest, delivery, and limits. • Explain the convergence of futures and spot prices. • Describe the role of an exchange in futures transactions. • Explain the differences between a normal and inverted futures market. • Describe the mechanics of the delivery process and contrast it with cash settlement. • Describe and compare different trading order types. • Describe the application of marking to market and hedge accounting for futures. • Compare and contrast forward and futures contracts.	**FMP-7**	**Chapter 7. Futures Markets** • Define and describe the key features of a futures contract, including the underlying asset, the contract price and size, trading volume, open interest, delivery, and limits. • Explain the convergence of futures and spot prices. • Describe the role of an exchange in futures transactions. • Explain the differences between a normal and inverted futures market. • Describe the mechanics of the delivery process and contrast it with cash settlement. • Describe and compare different trading order types. • Describe the application of marking to market and hedge accounting for futures. • Compare and contrast forward and futures contracts.	**No Changes**
FMP-8	**Chapter 8. Using Futures for Hedging** • Define and differentiate between short and long hedges and identify their appropriate uses. • Describe the arguments for and against hedging and the potential impact of hedging on firm profitability. • Define and calculate the basis, discuss various sources of basis risk, and explain how basis risks arise when hedging with futures. • Define cross hedging, and compute and interpret the hedge ratio and hedge effectiveness. • Calculate the profit and loss on a short or long hedge • Compute the optimal number of futures contracts needed to hedge an exposure, and explain and calculate the "tailing the hedge" adjustment. • Explain how to use stock index futures contracts to change a stock portfolio's beta. • Explain how to create a long-term hedge using a "stack and roll" strategy and describe some of the risks that arise from this strategy.	**FMP-8**	**Chapter 8. Using Futures for Hedging** • Define and differentiate between short and long hedges and identify their appropriate uses. • Describe the arguments for and against hedging and the potential impact of hedging on firm profitability. • Define and calculate the basis, discuss various sources of basis risk, and explain how basis risks arise when hedging with futures. • Define cross hedging, and compute and interpret the hedge ratio and hedge effectiveness. • Calculate the profit and loss on a short or long hedge • Compute the optimal number of futures contracts needed to hedge an exposure, and explain and calculate the "tailing the hedge" adjustment. • Explain how to use stock index futures contracts to change a stock portfolio's beta. • Explain how to create a long-term hedge using a "stack and roll" strategy and describe some of the risks that arise from this strategy.	**No Changes**
FMP-9	**Chapter 9. Foreign Exchange Markets** • Explain and describe the mechanics of spot quotes, forward quotes, and futures quotes in the foreign exchange markets, and distinguish between bid and ask exchange rates. • Calculate bid-ask spread and explain why the bid-ask spread for spot quotes may be different from the bid-ask spread for forward quotes. • Compare outright (forward) and swap transactions. • Define, compare, and contrast transaction risk, translation risk, and economic risk. • Describe examples of transaction, translation, and economic risks, and explain how to hedge these risks. • Describe the rationale for multi-currency hedging using options. • Identify and explain the factors that determine exchange rates. • Calculate and explain the effect of an appreciation/depreciation of a currency relative to another. • Explain the purchasing power parity theorem and use this theorem to calculate the appreciation or depreciation of a foreign currency. • Describe the relationship between nominal and real interest rates. • Describe how a non-arbitrage assumption in the foreign exchange markets leads to the interest rate parity theorem, and use this theorem to calculate forward foreign exchange rates. • Distinguish between covered and uncovered interest rate parity conditions.	**FMP-9**	**Chapter 9. Foreign Exchange Markets** • Explain and describe the mechanics of spot quotes, forward quotes, and futures quotes in the foreign exchange markets, and distinguish between bid and ask exchange rates. • Calculate bid-ask spread and explain why the bid-ask spread for spot quotes may be different from the bid-ask spread for forward quotes. • Compare outright (forward) and swap transactions. • Define, compare, and contrast transaction risk, translation risk, and economic risk. • Describe examples of transaction, translation, and economic risks, and explain how to hedge these risks. • Describe the rationale for multi-currency hedging using options. • Identify and explain the factors that determine exchange rates. • Calculate and explain the effect of an appreciation/depreciation of a currency relative to another. • Explain the purchasing power parity theorem and use this theorem to calculate the appreciation or depreciation of a foreign currency. • Describe the relationship between nominal and real interest rates. • Describe how a non-arbitrage assumption in the foreign exchange markets leads to the interest rate parity theorem, and use this theorem to calculate forward foreign exchange rates. • Distinguish between covered and uncovered interest rate parity conditions.	**No Changes**
FMP-10	**Chapter 10. Pricing Financial Forwards and Futures** • Define and describe financial assets • Define short-selling and calculate the net profit of a short sale of a dividend-paying stock. • Describe the differences between forward and futures contracts and explain the relationship between forward and spot prices. • Calculate the forward price given the underlying asset's spot price, and describe an arbitrage argument between spot and forward prices. • Distinguish between the forward price and the value of a forward contract. • Calculate the value of a forward contract on a financial asset that does or does not provide income or yield. • Explain the relationship between forward and futures prices. • Calculate the value of a stock index futures contract and explain the concept of index arbitrage.	**FMP-10**	**Chapter 10. Pricing Financial Forwards and Futures** • Define and describe financial assets • Define short-selling and calculate the net profit of a short sale of a dividend-paying stock. • Describe the differences between forward and futures contracts and explain the relationship between forward and spot prices. • Calculate the forward price given the underlying asset's spot price, and describe an arbitrage argument between spot and forward prices. • Distinguish between the forward price and the value of a forward contract. • Calculate the value of a forward contract on a financial asset that does or does not provide income or yield. • Explain the relationship between forward and futures prices. • Calculate the value of a stock index futures contract and explain the concept of index arbitrage.	**No Changes**
FMP-11	**Chapter 11. Commodity Forwards and Futures** • Explain the key differences between commodities and financial assets. • Define and apply commodity concepts such as storage costs, carry markets, lease rate, and convenience yield. • Identify factors that impact prices on agricultural commodities, metals, energy, and weather derivatives. • Explain the formula for pricing commodity forwards. • Describe an arbitrage transaction in commodity forwards, and compute the potential arbitrage profit. • Define the lease rate and explain how it determines the no-arbitrage values for commodity forwards and futures. • Describe the cost of carry model and determine the impact of storage costs and convenience yields on commodity forward prices and no-arbitrage bounds. • Compute the forward price of a commodity with storage costs. • Explain how to create a synthetic commodity position, and use it to explain the relationship between the forward price and the expected future spot price. • Explain the impact of systematic and nonsystematic risk on current futures prices and expected future spot prices. • Define and interpret normal backwardation and contango.	**FMP-11**	**Chapter 11. Commodity Forwards and Futures** • Explain the key differences between commodities and financial assets. • Define and apply commodity concepts such as storage costs, carry markets, lease rate, and convenience yield. • Identify factors that impact prices on agricultural commodities, metals, energy, and weather derivatives. • Explain the formula for pricing commodity forwards. • Describe an arbitrage transaction in commodity forwards, and compute the potential arbitrage profit. • Define the lease rate and explain how it determines the no-arbitrage values for commodity forwards and futures. • Describe the cost of carry model and determine the impact of storage costs and convenience yields on commodity forward prices and no-arbitrage bounds. • Compute the forward price of a commodity with storage costs. • Explain how to create a synthetic commodity position, and use it to explain the relationship between the forward price and the expected future spot price. • Explain the impact of systematic and nonsystematic risk on current futures prices and expected future spot prices. • Define and interpret normal backwardation and contango.	**No Changes**
FMP-12	**Chapter 12. Options Markets** • Describe the various types and uses of options; define moneyness • Explain the payoff function and calculate the profit and loss from an options position.	**FMP-12**	**Chapter 12. Options Markets** • Describe the various types and uses of options; define moneyness • Explain the payoff function and calculate the profit and loss from an options position.	**LO Removed**

- **Explain the specification of exchange-traded stock option contracts, including that of nonstandard products.**
- Explain how dividends and stock splits can impact the terms of a stock option.
- Describe the application of commissions, margin requirements, and exercise procedures to exchange-traded options and explain the trading characteristics of these options.
- Define and describe warrants, convertible bonds, and employee stock options.

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FMP-13 **Chapter 13. Properties of Options**
- Identify the six factors that affect an option's price.
- Identify and compute upper and lower bounds for option prices on non-dividend and dividend paying stocks.
- Explain put-call parity and apply it to the valuation of European and American stock options, with dividends and without dividends, and express it in terms of forward prices.
- Explain and assess potential rationales for using the early exercise features of American call and put options.

FMP-13 **Chapter 13. Properties of Options** — **No Changes**
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FMP-14 **Chapter 14. Trading Strategies**
- Explain the motivation to initiate a covered call or a protective put strategy.
- Describe principal protected notes (PPNs) and explain necessary conditions to create a PPN.
- Describe the use and calculate the payoffs of various spread strategies.
- Describe the use and explain the payoff functions of combination strategies.

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FMP-15 **Chapter 15. Exotic Options**
- Define and contrast exotic derivatives and plain vanilla derivatives.
- Describe some of the reasons that drive the development of exotic derivative products.
- Explain how any derivative can be converted into a zero-cost product.
- Describe how standard American options can be transformed into nonstandard American options.
- Identify and describe the characteristics and pay-off structure of the following exotic options: gap, forward start, compound, chooser, barrier, binary, lookback, Asian, exchange, and basket options.
- Describe and contrast volatility and variance swaps.
- Explain the basic premise of static option replication and how it can be applied to hedging exotic options.

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FMP-16 **Chapter 16. Properties of Interest Rates**
- Describe Treasury rates, LIBOR, Secured Overnight Financing Rate (SOFR), and repo rates and explain what is meant by the "risk-free" rate.
- Calculate the value of an investment using different compounding frequencies.
- Convert interest rates based on different compounding frequencies.
- Calculate the theoretical price of a bond using spot rates.
- Calculate the Macaulay duration, modified duration, and dollar duration of a bond.
- Evaluate the limitations of duration and explain how convexity addresses some of them.
- Calculate the change in a bond's price given its duration, its convexity, and a change in interest rates.
- Derive forward interest rates from a set of spot rates.
- Derive the value of the cash flows from a forward rate agreement (FRA).
- Calculate zero-coupon rates using the bootstrap method.
- Compare and contrast the major theories of the term structure of interest rates.

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- Calculate zero-coupon rates using the bootstrap method.
- Compare and contrast the major theories of the term structure of interest rates.

FMP-17 **Chapter 17. Corporate Bonds**
- Describe features of bond trading, and explain the behavior of bond yield.
- Describe a bond indenture and explain the role of the corporate trustee in a bond indenture.
- Define high-yield bonds, and describe types of high-yield bond issuers and some of the payment features unique to high yield bonds.
- Differentiate between credit default risk and credit spread risk.
- Describe event risk and explain what may cause it to manifest in corporate bonds.
- Describe the different characteristics of bonds such as issuer, maturity, interest rate, and collateral.
- Describe the mechanisms by which corporate bonds can be retired before maturity.
- Define recovery rate and default rate and differentiate between an issue default rate and a dollar default rate.
- Evaluate the expected return from a bond investment and identify the components of the bond's expected return.

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FMP-18 **Chapter 18. Mortgages and Mortgage-Backed Securities**
- Describe the various types of residential mortgage products.
- Calculate a fixed rate mortgage payment, and its principal and interest components.
- Summarize the securitization process of mortgage backed securities (MBS), particularly formation of mortgage pools including specific pools and to-be-announceds (TBAs).
- Calculate weighted average coupon, weighted average maturity, single monthly mortality rate (SMM), and conditional prepayment rate (CPR) for a mortgage pool.
- Describe the process of trading of pass-through agency MBS.
- Explain the mechanics of different types of agency MBS products, including collateralized mortgage obligations (CMOs), interest-only securities (IOs), and principal-only securities (POs).
- Describe a dollar roll transaction and how to value a dollar roll.
- Describe the mortgage prepayment option and the factors that influence prepayments; explain prepayment modeling and its four components: refinancing, turnover, defaults, and curtailments.
- Describe the steps in valuing an MBS using Monte Carlo simulation.
- Define Option Adjusted Spread (OAS), and explain its challenges and its uses.

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- Describe the steps in valuing an MBS using Monte Carlo simulation.
- Define Option Adjusted Spread (OAS), and explain its challenges and its uses.

FMP-19 **Chapter 19. Interest Rate Futures**
- Identify the most commonly used day count conventions, describe the markets that each one is typically used in, and apply each to an interest calculation.
- Calculate the conversion of a discount rate to a price for a US Treasury bill.
- Differentiate between the clean and dirty price for a US Treasury bond; calculate the accrued interest and dirty price on a US Treasury bond.
- Explain and calculate a US Treasury bond futures contract conversion factor.
- Calculate the cost of delivering a bond into a Treasury bond futures contract.
- Describe the impact of the level and shape of the yield curve on the cheapest-to-deliver Treasury bond decision.
- Calculate the theoretical futures price for a Treasury bond futures contract.
- Calculate the final contract price on a Eurodollar futures contract, and compare Eurodollar futures to FRAs.
- Describe and compute the Eurodollar futures contract convexity adjustment.
- Calculate the duration-based hedge ratio and create a duration-based hedging strategy using interest rate futures.
- Explain the limitations of using a duration-based hedging strategy.

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- Describe the impact of the level and shape of the yield curve on the cheapest-to-deliver Treasury bond decision.
- Calculate the theoretical futures price for a Treasury bond futures contract.
- Calculate the final contract price on a Eurodollar futures contract, and compare Eurodollar futures to FRAs.
- Describe and compute the Eurodollar futures contract convexity adjustment.
- Calculate the duration-based hedge ratio and create a duration-based hedging strategy using interest rate futures.
- Explain the limitations of using a duration-based hedging strategy.

FMP-20 **Chapter 20. Swaps**
- Explain the mechanics of a plain vanilla interest rate swap and compute its cash flows.
- Explain how a plain vanilla interest rate swap can be used to transform an asset or a liability and calculate the resulting cash flows.
- Explain the role of financial intermediaries in the swaps market.
- Describe the role of the confirmation in a swap transaction.
- Describe the comparative advantage argument for the existence of interest rate swaps and evaluate some of the criticisms of this argument.
- Explain how the discount rates in a plain vanilla interest rate swap are computed.
- Calculate the value of a plain vanilla interest rate swap based on two simultaneous bond positions.
- Calculate the value of a plain vanilla interest rate swap from a sequence of forward rate agreements (FRAs).
- Explain the mechanics of a currency swap and compute its cash flows.
- Explain how a currency swap can be used to transform an asset or liability and calculate the resulting cash flows.
- Calculate the value of a currency swap based on two simultaneous bond positions.
- Calculate the value of a currency swap based on a sequence of forward exchange rates.
- Identify and describe other types of swaps, including commodity, volatility, credit default, and exotic swaps.
- Describe the credit risk exposure in a swap position.

FMP-20 **Chapter 20. Swaps** — **No Changes**
- Explain the mechanics of a plain vanilla interest rate swap and compute its cash flows.
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- Calculate the value of a currency swap based on two simultaneous bond positions.
- Calculate the value of a currency swap based on a sequence of forward exchange rates.
- Identify and describe other types of swaps, including commodity, volatility, credit default, and exotic swaps.
- Describe the credit risk exposure in a swap position.

Topic 4 VALUATION AND RISK MODELS—Part I Exam Weight | 30%

VRM-1 **Chapter 1. Measures of Financial Risk**
- Define the VaR measure of risk, describe assumptions about return distributions and holding period, and explain the limitations of VaR.
- Describe the mean-variance framework and the efficient frontier.
- Compare the normal distribution with the typical distribution of returns of risky financial assets such as equities.
- Explain and calculate Expected Shortfall (ES), and compare and contrast VaR and ES.
- Define the properties of a coherent risk measure and explain the meaning of each property.
- Explain why VaR is not a coherent risk measure.

VRM-2 **Chapter 2. Calculating and Applying VaR**
- Explain and give examples of linear and non-linear **portfolios**.
- Describe and calculate VaR for linear derivatives.
- Describe and explain the historical simulation approach for computing VaR and ES.
- Describe the delta-normal approach and use it to calculate VaR for non-linear derivatives.
- Describe the limitations of the delta-normal method.
- Explain the structured Monte Carlo method for computing VaR and identify its strengths and weaknesses.
- Describe the implications of correlation breakdown for scenario analysis.
- Describe worst-case scenario (WCS) analysis and compare WCS to VaR.

VRM-3 **Chapter 3. Measuring and Monitoring Volatility**
- Explain how asset return distributions tend to deviate from the normal distribution.
- Explain reasons for fat tails in a return distribution and describe their implications.
- Distinguish between conditional and unconditional distributions and describe the implications of regime switching on quantifying volatility.
- Compare and contrast different parametric and non-parametric approaches for estimating conditional volatility.
- Apply the exponentially weighted moving average (EWMA) approach to estimate volatility and describe alternative approaches to weighting historical return data.
- Evaluate implied volatility as a predictor of future volatility and its shortcomings.
- Explain and apply approaches to estimate long horizon volatility/VaR, and describe the process of mean reversion according to a GARCH (1,1) model.
- Describe an example of updating correlation estimates.

VRM-4 **Chapter 4. External and Internal Credit Ratings**
- Describe external rating scales, the rating process, and the link between ratings and default.
- Define conditional and unconditional default probabilities and explain the distinction between the two.
- Define and use the hazard rate to calculate unconditional default probability of a credit asset.
- Define recovery rate and calculate the expected loss from a loan.
- Explain and compare the through-the-cycle and at-the-point internal ratings approaches
- Describe alternative methods to credit ratings produced by rating agencies.
- Compare external and internal ratings approaches.
- Describe and interpret a ratings transition matrix and explain its uses.
- Describe the relationships between changes in credit ratings and changes in stock prices, bond prices, and credit default swap spreads.
- Explain historical failures and potential challenges to the use of credit ratings in making investment decisions.

VRM-5 **Chapter 5. Country Risk: Determinants, Measures, and Implications**
- Explain how a country's position in the economic growth life cycle, political risk, legal risk, and economic structure affect its risk exposure.
- Evaluate composite measures of risk that incorporate all major types of country risk.
- Compare instances of sovereign default in both foreign currency debt and local currency debt, and explain common causes of sovereign defaults.
- Describe the consequences of sovereign default.
- Describe factors that influence the level of sovereign default risk; explain and assess how rating agencies measure sovereign default risks.
- Describe characteristics of sovereign credit spreads and sovereign CDS, and compare the use of sovereign spreads to credit ratings.

VRM - 6 **Chapter 6. Measuring Credit Risk**
- Explain the distinctions between economic capital and regulatory capital, and describe how economic capital is derived.
- **Describe the degree of dependence typically observed among the loan defaults in a bank's loan portfolio, and explain the implications for the portfolio's default rate**
- Define and calculate expected loss (EL).
- Define and explain unexpected loss (UL).
- Estimate the mean and standard deviation of credit losses assuming a binomial distribution.
- Describe the Gaussian copula model and its application.
- Describe and apply the Vasicek model to estimate default rate and credit risk capital for a bank.
- Describe the CreditMetrics model and explain how it is applied in estimating economic capital.
- Describe and use the Euler's theorem to determine the contribution of a loan to the overall risk of a portfolio.
- Explain why it is more difficult to calculate credit risk capital for derivatives than for loans.
- Describe challenges to quantifying credit risk.

VRM - 7 **Chapter 7. Operational Risk**
- Describe the different categories of operational risk and explain how each type of risk can arise.
- Compare the basic indicator approach, the standardized approach, and the advanced measurement approach for calculating operational risk regulatory capital.
- Describe the standardized measurement approach and explain the reasons for its introduction by the Basel committee.
- Explain how a loss distribution is derived from an appropriate loss frequency distribution and loss severity distribution using Monte Carlo simulations.
- Describe the common data issues that can introduce inaccuracies and biases in the estimation of loss frequency and severity distributions.
- Describe how to use scenario analysis in instances when data is scarce.
- Describe how to identify causal relationships and how to use Risk and Control Self-Assessment (RCSA), Key Risk Indicators (KRIs), and education to measure and manage operational risks.
- Describe the allocation of operational risk capital to business units.
- Explain how to use the power law to measure operational risk.
- Explain how the moral hazard and adverse selection problems faced by insurance companies relate to insurance against operational risk.

VRM - 8 **Chapter 8. Stress Testing**
- Describe the rationale for the use of stress testing as a risk management tool.
- Explain key considerations and challenges related to stress testing, including choice of scenarios, regulatory specifications, model building, and reverse stress testing
- Describe the relationship between stress testing and other risk measures, particularly in enterprise-wide stress testing.
- Describe stressed VaR and stressed ES, **including their advantages and disadvantages**, and compare the process of determining stressed VaR and ES to that of traditional VaR and ES.
- Describe the responsibilities of the board of directors, senior management, and the internal audit function in stress testing governance
- **Describe the role of policies and procedures, validation, and independent review in stress testing governance.**
- Describe the Basel stress testing principles for banks regarding the implementation of stress testing.

VRM-9 **Chapter 9. Pricing Conventions, Discounting, and Arbitrage**
- Define discount factor and use a discount function to compute present and future values.

Topic 4 VALUATION AND RISK MODELS—Part I Exam Weight | 30%

VRM-1 **Chapter 1. Measures of Financial Risk** — No Changes
- Describe the mean-variance framework and the efficient frontier. — LO Order Switched (same content)
- Compare the normal distribution with the typical distribution of returns of risky financial assets such as equities.
- Define the VaR measure of risk, describe assumptions about return distributions and holding period, and explain the limitations of VaR.
- Explain and calculate Expected Shortfall (ES), and compare and contrast VaR and ES.
- Define the properties of a coherent risk measure and explain the meaning of each property.
- Explain why VaR is not a coherent risk measure.

VRM-2 **Chapter 2. Calculating and Applying VaR** — No Changes
- Explain and give examples of linear and non-linear portfolios. — LO Order Switched (same content)
- Describe and explain the historical simulation approach for computing VaR and ES.
- Describe the delta-normal approach and use it to calculate VaR for non-linear derivatives.
- Describe and calculate VaR for linear derivatives.
- Describe the limitations of the delta-normal method.
- Explain the structured Monte Carlo method for computing VaR and identify its strengths and weaknesses.
- Describe the implications of correlation breakdown for scenario analysis.
- Describe worst-case scenario (WCS) analysis and compare WCS to VaR.

VRM-3 **Chapter 3. Measuring and Monitoring Volatility** — LO Order Switched (same content)
- Explain how asset return distributions tend to deviate from the normal distribution.
- Explain reasons for fat tails in a return distribution and describe their implications.
- Distinguish between conditional and unconditional distributions and describe regime switching — Wording removed (no impact)
- Compare and contrast different approaches for estimating conditional volatility. — Wording removed (no impact)
- Apply the exponentially weighted moving average (EWMA) approach to estimate volatility and describe alternative approaches to weighting historical return data.
- **Apply the GARCH (1,1) model to estimate volatility.** — New LO
- Explain and apply approaches to estimate long horizon volatility/VaR, and describe the process of mean reversion according to a GARCH (1,1) model.
- Evaluate implied volatility as a predictor of future volatility and its shortcomings.
- Describe an example of updating correlation estimates.

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- Describe the relationships between changes in credit ratings and changes in stock prices, bond prices, and credit default swap spreads.
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VRM-5 **Chapter 5. Country Risk: Determinants, Measures, and Implications** — NO Changes
- Explain how a country's position in the economic growth life cycle, political risk, legal risk, and economic structure affect its risk exposure.
- Evaluate composite measures of risk that incorporate all major types of country risk.
- Compare instances of sovereign default in both foreign currency debt and local currency debt, and explain common causes of sovereign defaults.
- Describe the consequences of sovereign default.
- Describe factors that influence the level of sovereign default risk; explain and assess how rating agencies measure sovereign default risks.
- Describe characteristics of sovereign credit spreads and sovereign CDS, and compare the use of sovereign spreads to credit ratings.

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- Explain how to use the power law to measure operational risk.
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- Describe stressed VaR and stressed ES, including their advantages and disadvantages, and compare the process of determining stressed VaR and ES to that of traditional VaR and ES.
- Explain key considerations and challenges related to stress testing, including choice of scenarios, regulatory specifications, model building, and reverse stress testing
- **Describe reverse stress testing and describe an example of regulatory stress testing.** — LO Added
- Describe the responsibilities of the board of directors, senior management, and the internal audit function in stress testing governance
- Describe the role of policies and procedures, validation, and independent review in stress testing governance.
- Describe the Basel stress testing principles for banks regarding the implementation of stress testing.

VRM-9 **Chapter 9. Pricing Conventions, Discounting, and Arbitrage**
- Define discount factor and use a discount function to compute present and future values.

	• Define the "law of one price," explain it using an arbitrage argument, and describe how it can be applied to bond pricing. • Identify arbitrage opportunities for fixed income securities with certain cash flows. • Identify the components of a US Treasury coupon bond, and compare the structure to Treasury STRIPS, including the difference between P-STRIPS and C-STRIPS. • Construct a replicating portfolio using multiple fixed income securities to match the cash flows of a given fixed- income security. • Differentiate between "clean" and "dirty" bond pricing and explain the implications of accrued interest with respect to bond pricing. • Describe the common day-count conventions used in bond pricing.		• Define the "law of one price," explain it using an arbitrage argument, and describe how it can be applied to bond pricing. • Identify arbitrage opportunities for fixed income securities with certain cash flows. • Identify the components of a US Treasury coupon bond, and compare the structure to Treasury STRIPS, including the difference between P-STRIPS and C-STRIPS. • Construct a replicating portfolio using multiple fixed income securities to match the cash flows of a given fixed- income security. • Differentiate between "clean" and "dirty" bond pricing and explain the implications of accrued interest with respect to bond pricing. • Describe the common day-count conventions used **to compute interest on a fixed-income security**	**Wording Added/Removed**
VRM-10	**Chapter 10. Interest Rates** • Calculate and interpret the impact of different compounding frequencies on a bond's value. • Define spot rate and compute discount factors given spot rates . • Interpret the forward rate, and compute forward rates given spot rates. • Define par rate and describe the equation for the par rate of a bond. • Interpret the relationship between spot, forward, and par rates. • Assess the impact of maturity on the price of a bond and the returns generated by bonds. • Define the "flattening" and "steepening" of rate curves and describe a trade to reflect expectations that a curve will flatten or steepen. • Describe a swap transaction and explain how a swap market defines par rates. • Describe overnight indexed swap (OIS) and distinguish OIS rates from LIBOR swap rates.	**VRM-10**	**Chapter 10. Interest Rates** • Calculate and interpret the impact of different compounding frequencies on a bond's value. • Define spot rate and compute discount factors given spot rates . • Interpret the forward rate, and compute forward rates given spot rates. • Define par rate and describe the equation for the par rate of a bond. • Interpret the relationship between spot, forward, and par rates. • Assess the impact of maturity on the price of a bond and the returns generated by bonds. • Define the "flattening" and "steepening" of rate curves and describe a trade to reflect expectations that a curve will flatten or steepen. • Describe a swap transaction and explain how a swap market defines par rates.	**LO Removed**
VRM-11	**Chapter 11. Bond Yields and Return Calculations** • Distinguish between gross and net realized returns, and calculate the realized return for a bond over a holding period including reinvestments. • Define and interpret the spread of a bond, and explain how a spread is derived from a bond price and a term structure of rates. • Define, interpret, and apply a bond's yield-to-maturity (YTM) to bond pricing. • Compute a bond's YTM given a bond structure and price. • Calculate the price of an annuity and a perpetuity. • Explain the relationship between spot rates and YTM. • Define the coupon effect and explain the relationship between coupon rate, YTM, and bond prices. • Explain the decomposition of the profit and loss (P&L) for a bond position or portfolio into separate factors including carry roll-down, rate change, and spread change effects. • Explain the following four common assumptions in carry roll-down scenarios: realized forwards, unchanged term structure, unchanged yields, and realized expectations of short-term rates; and calculate carry roll down under these assumptions.	**VRM-11**	**Chapter 11. Bond Yields and Return Calculations** • Distinguish between gross and net realized returns, and calculate the realized return for a bond over a holding period including reinvestments. • Define and interpret the spread of a bond, and explain how a spread is derived from a bond price and a term structure of rates. • Define, interpret, and apply a bond's yield-to-maturity (YTM) to bond pricing. • Compute a bond's YTM given a bond structure and price. • Calculate the price of an annuity and a perpetuity. • Explain the relationship between spot rates and YTM. • Define the coupon effect and explain the relationship between coupon rate, YTM, and bond prices. • Explain the decomposition of the profit and loss (P&L) for a bond position or portfolio into separate factors including carry roll-down, rate change, and spread change effects. • Explain the following four common assumptions in carry roll-down scenarios: realized forwards, unchanged term structure, unchanged yields, and realized expectations of short-term rates; and calculate carry roll down under these assumptions.	**No Changes**
VRM-12	**Chapter 12. Applying Duration, Convexity, and DV01** • Describe a one-factor interest rate model and identify common examples of interest rate factors. • Define and compute the DV01 of a fixed income security given a change in yield and the resulting change in price. • Calculate the face amount of bonds required to hedge an option position given the DV01 of each. • Define, compute, and interpret the effective duration of a fixed income security given a change in yield and the resulting change in price. • Compare and contrast DV01 and effective duration as measures of price sensitivity. • Define, compute, and interpret the convexity of a fixed income security given a change in yield and the resulting change in price. • Explain the process of calculating the effective duration and convexity of a portfolio of fixed income securities. • Describe an example of hedging based on effective duration and convexity. • Construct a barbell portfolio to match the cost and duration of a given bullet investment, and explain the advantages and disadvantages of bullet versus barbell portfolios.	**VRM-12**	**Chapter 12. Applying Duration, Convexity, and DV01** • Describe a one-factor interest rate model and identify common examples of interest rate factors. • Define and compute the DV01 of a fixed income security given a change in yield and the resulting change in price. • Calculate the face amount of bonds required to hedge an option position given the DV01 of each. • Define, compute, and interpret the effective duration of a fixed income security given a change in yield and the resulting change in price. • Compare and contrast DV01 and effective duration as measures of price sensitivity. • Define, compute, and interpret the convexity of a fixed income security given a change in yield and the resulting change in price. • **Calculate the DV01**, duration, and convexity of a portfolio of fixed-income securities. • Describe an example of hedging based on effective duration and convexity. • Construct a barbell portfolio to match the cost and duration of a given bullet investment, and explain the advantages and disadvantages of bullet versus barbell portfolios.	**Wording added**
VRM-13	**Chapter 13. Modeling Non-Parallel Term Structure Shifts and Hedging** • Describe the principal components analysis and explain its use in understanding term structure movements. • Define key rate exposures and know the characteristics of key rate exposure factors including partial '01s and forward-bucket '01s. • Describe key-rate shift analysis. • Define, calculate, and interpret key rate '01 and key rate duration. • Compute the positions in hedging instruments necessary to hedge the key rate risks of a portfolio. • Relate key rates, partial '01s and forward-bucket '01s, and calculate the forward-bucket '01 for a shift in rates in one or more buckets. • Apply key rate and **multi-factor analysis** to estimating portfolio volatility.	**VRM-13**	**Chapter 13. Modeling Non-Parallel Term Structure Shifts and Hedging** • Describe the principal components analysis and explain its use in understanding term structure movements. • Describe key-rate shift analysis and define key rate 01 (KR01) • **Calculate the KR01s of a portfolio given a set of key rates.** • Compute the positions in hedging instruments necessary to hedge the key rate risks of a portfolio. • Apply key rate analysis and **principal components** analysis to estimating portfolio volatility. • **Describe an interest rate bucketing approach, define forward bucket 01, and compare forward bucket 01s to KR01s.** • **Calculate the corresponding duration measure given a KR01 or forward bucket 01.**	**2 LOs Removed** **LOs combined** **LO Added** **Wording added/removed** **Lo Added** **Lo Added**
VRM-14	**Chapter 14. Binomial Trees** • Calculate the value of an American and a European call or put option using a one-step and two-step binomial model. • Describe how volatility is captured in the binomial model. • Describe how the value calculated using a binomial model converges as time periods are added. • Define and calculate delta of a stock option. • Explain how the binomial model can be altered to price options on stocks with dividends, stock indices, currencies, and futures.	**VRM-14**	**Chapter 14. Binomial Trees** • Calculate the value of an American and a European call or put option using a one-step and two-step binomial model. • Describe how volatility is captured in the binomial model. • Describe how the value calculated using a binomial model converges as time periods are added. • Define and calculate delta of a stock option. • Explain how the binomial model can be altered to price options on stocks with dividends, stock indices, currencies, and futures.	**No Changes**
VRM-15	**Chapter 15. The Black-Scholes-Merton Model** • Explain the lognormal property of stock prices, the distribution of rates of return, and the calculation of expected return. • Compute the realized return and historical volatility of a stock. • Describe the assumptions underlying the Black-Scholes-Merton option pricing model. • Compute the value of a European option on a non-dividend-paying stock using the Black-Scholes- Merton model. • Define implied volatilities and describe how to compute implied volatilities from market prices of options using the Black-Scholes-Merton model. • Explain how dividends affect the decision to exercise early for American call and put options. • Compute the value of a European option using the Black-Scholes-Merton model on a dividend-paying stock, futures, and exchange rates. • Describe warrants, calculate the value of a warrant, and calculate the dilution cost of the warrant to existing shareholders.	**VRM-15**	**Chapter 15. The Black-Scholes-Merton Model** • Explain the lognormal property of stock prices, the distribution of rates of return, and the calculation of expected return. • Compute the realized return and historical volatility of a stock. • Describe the assumptions underlying the Black-Scholes-Merton option pricing model. • Compute the value of a European option on a non-dividend-paying stock using the Black-Scholes- Merton model. • Define implied volatilities and describe how to compute implied volatilities from market prices of options using the Black-Scholes-Merton model. • Explain how dividends affect the decision to exercise early for American call and put options. • Compute the value of a European option using the Black-Scholes-Merton model on a dividend-paying stock, futures, and exchange rates. • Describe warrants, calculate the value of a warrant, and calculate the dilution cost of the warrant to existing shareholders.	**No Changes**
VRM-16	**Chapter 16. Option Sensitivity Measures: The "Greeks"** • Describe and assess the risks associated with naked and covered option positions. • Describe the use of a stop loss hedging strategy, including its advantages and disadvantages, and explain how this strategy can generate naked and covered option positions. • Describe delta hedging for an option, forward, and futures contracts. • Compute the delta of an option. • Describe the dynamic aspects of delta hedging and distinguish between dynamic hedging and hedge-and-forget strategy. • Define and calculate the delta of a portfolio. • Define and describe theta, gamma, vega, and rho for option positions, and calculate the gamma and vega for a portfolio. • Explain how to implement and maintain a delta-neutral and a gamma-neutral position. • Describe the relationship between delta, theta, gamma, and vega. • Describe how portfolio insurance can be created through option instruments and stock index futures.	**VRM-16**	**Chapter 16. Option Sensitivity Measures: The "Greeks"** • Describe and assess the risks associated with naked and covered option positions. • Describe the use of a stop loss hedging strategy, including its advantages and disadvantages, and explain how this strategy can generate naked and covered option positions. • Compute the delta of an option. • **Explain delta hedging for an option position, including its dynamic aspects.** • Define and describe vega, gamma, theta, and rho for option positions and calculate the gamma and vega of an option. • Explain how to implement and maintain a delta-neutral and a gamma-neutral position. • Describe the relationship between delta, theta, gamma, and vega. • Calculate the delta, gamma, and vega of a portfolio. • **Describe how to implement portfolio insurance and how this strategy compares with delta hedging.**	**LOs Removed** **Lo Added** **Lo Added**
THE END	**THE END**	**THE END**	**THE END**	**THE END**