



2020 FRM Part II

百题巅峰班

信用风险测量与管理

2020 年 2 月

2. Credit Risk Measurement and Management

2.1. Key Point: Credit Decision and Credit Analysis

2.1.1. 重要知识点

2.1.1.1. Credit Decision and Credit Analysis

Consumers	Wealth, salary, or incoming cash per period, expenses per period, assets such as houses and cars, amount of debt, net cash available to service debt. Credit scoring models and some manual input and review for large exposures such as mortgage loans or automobile loans.
Corporations	Liquidity, cash flow combined with earnings capacity and profitability, capital position, state of the economy, strength of the industry. More complex than consumer analysis because companies are so diverse in terms of assets, cash flow, financial structure, etc.
Financial Institutions	Similar to nonfinancial firms but bank specific. Liquidity, capital position, historical performance including earnings capacity over time, asset quality, state of the economy, strength of industry. Qualitative analysis is even more important for financial firms than for nonfinancial firms.
Sovereigns	Financial factors including the country's external debt load and debt relative to the overall economy; tax receipts are important. More subjective than for financial and nonfinancial firms.

2.1.2. 基础题

Q-1. Golin and Delhaise divide credit analysis into four areas according to borrower type:

- I. Consumer credit analysis is the evaluation of the creditworthiness of individual consumers;
- II. Corporate credit analysis is the evaluation of nonfinancial companies such as manufacturers, and nonfinancial service providers;
- III. Financial institution credit analysis is the evaluation of financial companies including banks and nonbank financial institutions, such as insurance companies and investment funds;
- IV. Sovereign/municipal credit analysis is the evaluation of the credit risk associated with the financial obligations of nations, subnational governments, and public authorities, as well as the impact of such risks on obligations of nonstate entities operating in specific jurisdictions.

According to Golin and Delhaise, each of the following is true about key features of credit analysis with respect to borrower type, except which is not true?

- A. Individuals (consumers): Credit analysis is amenable to automation and the use of scoring models and statistical tools to correlate risk to limited number of variables
- B. Non-financial corporations: Compared to consumers, tends to be more detailed and "hands-on" (i.e. less automated); key variables are likely to include liquidity, cash flow, near-term earnings capacity and profitability, solvency or capital position
- C. Financial Companies: In contrast to corporate (non-financial) credit analysis, qualitative analysis and asset quality are not important, but cash flow is a highly important (a "key indicator")
- D. Sovereigns: Includes analysis of country risk, which is primarily political dynamics and state of the economy; and systematic risk, which includes the regulatory regime and the financial system

Q-2. ABC Company, domiciled in a country with a strong legal system, is applying for a USD 100,000 loan with an annual interest rate of 5% to be used exclusively on expanding its business and not to repay current debt. The loan will be secured by the company's factory buildings, which have an appraised value of USD 200,000. The company has an annual operating profit of USD 3,000. Which of the following statements relating to the credit risk of this company can most likely be inferred from the given data?

- A. The company's capacity to pay is low.
- B. The company's willingness to pay is low.
- C. The loan exhibits a high loss given default.
- D. The loan's exposure at default will increase.

2.2. Key Point: Credit VaR

2.2.1. 重要知识点

2.2.1.1. Credit VaR

Type of Credit Loss	Description	Formula
Expected Credit Loss	Represent the expected value of the credit loss	$EL = PD \times LGD \times EAD$
Unexpected Credit Loss	Quantile of the credit loss in excess of the expected loss	$UL = \text{Credit VaR} = WCL - EL$

2.2.2. 基础题

Q-3. A credit analyst at a bank has been asked to produce an exposure analysis for three of the loans in the bank's portfolio. Loan information assembled by the analyst as well as the bank's internal default.

Loan	Tenor (Years)	Notional (USD)	Loss Given Default	S&P Rating
1	2	30,000,000	0.75	BB-
2	3	100,000,000	0.90	A
3	1	100,000,000	0.70	B+

Probability of Default (PD)			
	Tenor (Years)		
Loan Quality	1	2	3
Investment Grade	0.01	0.02	0.03
Non-Investment Grade	0.05	0.10	0.20

There is no collateral provided by the borrower for these loans, so the analyst uses the notional amount provided above as the Exposure at Default. Which of the following correctly orders the expected loss for each loan from lowest to highest?

- A. Loan 1 < Loan 2 < Loan 3
- B. Loan 1 < Loan 3 < Loan 2
- C. Loan 2 < Loan 3 < Loan 1
- D. Loan 2 < Loan 1 < Loan 3

Q-4. A manager of a mutual fund has taken significant credit exposure to Europe and Asia. Concerned with uncertain market conditions, the manager wants to change the assumptions in the fund's risk models by increasing the default correlation between bonds issued in Europe and bonds issued in Asia. If the default correlation is increased and all the other parameters are kept the same, which of the following is true?

- A. The expected loss of the portfolio will increase.
- B. The unexpected loss of the portfolio will decrease.
- C. The expected loss of the portfolio will decrease.
- D. The unexpected loss of the portfolio will increase.

Q-5. Suppose there is a \$1,000,000 portfolio with $n = 50$ credits that each has a default probability of $\pi = 0.02$ and a zero recovery rate, the default correlation is 0. In addition, each credit is equally weighted and has a terminal value of \$20,000 if there is no default. The number of defaults is binomially distributed with parameters of $n = 50$ and $\pi = 0.02$, and the 95th percentile of the number of defaults based on this distribution is 3. What is the credit VaR at the 95% confidence level based on these parameters?

- A. \$30,000

- B. \$40,000
- C. \$50,000
- D. \$60,000

Q-6. Becky the Risk Analyst is trying to estimate the credit value at risk (CVaR) of a three-bond portfolio, where the CVaR is defined as the maximum unexpected loss at 99.0% confidence over a one-month horizon. The bonds are independent (i.e., no default correlation) and identical with a one-month forward value of \$1.0 million each, a one-year cumulative default probability of 4.0%, and an assumed zero recovery rate. Which is nearest to the one-month 99.0% CVaR?

- A. \$989,812
- B. \$1.0 million
- C. \$1.7 million
- D. \$2.3 million

Q-7. At the beginning of the year, a firm bought an AA-rated corporate bond at USD 110 per USD 100 face value. Using market data, the risk manager estimates the following year-end values for the bond based on interest rate simulations informed by the economics team:

Rating	Year-End Bonds Value
AAA	112
AA	109
A	105
BBB	101
BB	92
B	83
CCC	73
Default	50

In addition, the risk manager estimates the 1-year transition probabilities on the AA-rated corporate bond:

Rating	Probability of State
AAA	3.00%

AA	85.00%
A	7.00%
BBB	4.00%
BB	0.35%
B	0.25%
CCC	0.15%
Default	0.25%

What is the 1-year 95% credit VaR per USD 100 of face value closest to?

- A. USD 9
- B. USD 18
- C. USD 30
- D. USD 36

Q-8. Suppose there is a \$1,000,000 portfolio with n credits that each have a default probability, $\pi = 2\%$ and a zero recovery rate. The default correlation is 0 and $n = 1,000$. There is a probability of 28 defaults at the 95th percentile based on the binomial distribution with the parameters of $n = 1,000$ and $\pi = 0.02$. What is the credit VaR at the 95% confidence level based on these parameters?

- A. \$7,000
- B. \$8,000
- C. \$9,000
- D. \$10,000

Q-9. Consider a pair of two speculative credits, rated BB and BB-, with default probabilities respectively of 2% and 3%. If their joint default probability is 0.4%, which is nearest to the implied default correlation?

- A. Zero
- B. 0.083
- C. 0.1424
- D. 0.3750

2.3. Key Point: Capital Structure

2.3.1. 重要知识点

2.3.1.1. EL and UL (in statistical terms)

$$EL = PD \times EA \times LR$$

$$UL = EA \times \sqrt{PD \times \sigma_{LR}^2 + LR^2 \times \sigma_{PD}^2}$$

- Where σ_{LR} = standard deviation of the loss rate LR
- σ_{PD} = standard deviation of the default probability PD
- $\sigma_{PD}^2 = PD_{sta} - PD$

2.3.1.2. Unexpected Loss Contribution

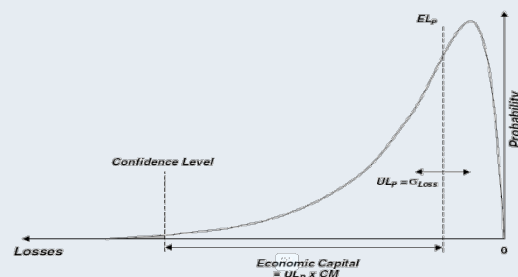
$$\begin{aligned} ULMC_i &= \frac{\partial UL_P}{\partial UL_i} = \frac{1}{2UL_P} \times \frac{\partial (UL_P^2)}{\partial UL_i} \\ &= \frac{1}{2UL_P} \times \frac{\partial \left(\sum_{i=1}^n \sum_{j=1}^n \rho_{ij} UL_i UL_j \right)}{\partial UL_i} = \frac{\sum_{j=1}^n UL_j \rho_{ij}}{UL_P} \end{aligned}$$

2.3.1.3. Total Contribution to the Portfolio's UL

$$UL_P = \sum_{i=1}^n ULMC_i \times UL_i$$

$$ULC_i = ULMC_i \times UL_i = \frac{\sum_{j=1}^n UL_j \times \rho_{ij}}{UL_P} \times UL_i$$

2.3.1.4. Economic Capital



- Economic Capital_p = UL_p × CM
- -Economic Capital_i = ULC_i × CM
- CM = capital multiplier

2.3.2. 基础题

Q-10. A bank's credit exposure to a customer consists of the following:

- Exposure amount is \$50 million
- Probability of default is 2%
- Loss rate is 50%
- Standard deviation of loss rate is 40%

Which is nearest to the exposure's unexpected loss?

- A. \$2.48 million
- B. \$3.29 million
- C. \$4.50 million
- D. \$7.75 million

Q-11. A bank has extended two loans to customers in the same industry. Both loans are have an exposure amount of \$50 million, default probability of 2%, loss rate of 50%, and standard deviation of loss rate of 60% such that each loan has an expected loss of \$500,000 and an unexpected loss of \$5.5 million. In this way, the bank's credit portfolio consists of these two credit assets; and the default correlation between the two loans is 28%. Which is nearest to the risk contribution of each asset to the portfolio's unexpected loss?

- A. \$3.33 million
- B. \$4.40 million
- C. \$5.37 million
- D. \$5.50 million

2.4. Key Point: Probability of Default in Rating System

2.4.1. 重要知识点

2.4.1.1. Key Features of a Good Rating System

- Measurability and Verifiability
- Objectivity and Homogeneity
- Specificity

2.4.1.2. Cumulative Default Probability

$$PD_k^{\text{cumulated}} = \frac{Def_i}{Names_t}$$

2.4.1.3. Marginal Default Probability

$$PD_k^{\text{marg}} = PD_{t+k}^{\text{cumulated}} - PD_t^{\text{cumulated}}$$

2.4.1.4. Forward Probability (Contingent to the Survival Rate)

$$PD_{t,t+k}^{\text{Forw}} = \frac{Def_{t+k} - Def_t}{Names \text{ survived}_t}$$

2.4.1.5. Survival Rate

$$SR_{t,t+k}^{\text{Forw}} = (1 - PD_{t,t+k}^{\text{Forw}}) (1 - PD_t^{\text{cumulated}}) = \prod_{i=1}^t SR_i^{\text{Forw}}$$

2.4.2. 基础题

Q-12. An analyst has noted that the default frequency in the pharmaceutical industry has been constant at 8% for an extended period of time. Based on this information, which of the following statements is most likely correct for a randomly selected firm following a Bernoulli distribution?

- I. The cumulative probability that a randomly selected firm in the pharmaceutical industry will default is constant.
- II. The probability that the firm survives for the next 6 years without default is approximately 60%.

- A. I only
- B. II only
- C. Both I and II
- D. Neither I nor II

Q-13. A portfolio consists of 10 independent bonds. There will be one default on average in 5 years. What is the probability that only exactly one default in a year.

- A. 16.37%
- B. 26.84%
- C. 36.96%
- D. 45.28%

Q-14. As a result of the credit crunch, a small retail bank wants to better predict and model the likelihood that its larger commercial loans might default. It is developing an internal ratings-based approach to assess its commercial customers. Given this one-year transition matrix, what is the probability that a loan currently rated at B will default over a two-year period?

Rating at Beginning of Period	Rating at End of Period			
	A	B	C	D
A	0.90	0.10	0.00	0.00
B	0.00	0.75	0.15	0.10
C	0.00	0.05	0.55	0.40

- A. 17.50%
- B. 20.0%
- C. 21.1%
- D. 23.5%

Q-15. A risk analyst at a mid-size hedge fund is evaluating the credit risk of several trade

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positions. The hedge fund specializes in corporate debt and runs a strategy that utilizes both relative value and long-only trades using CDS and bonds. One of the new trades at the hedge fund is a B-rated long bond valued at JPY 10 billion. Some of the hedge fund's newest clients, including the B-rated bond holders, are restricted from withdrawing their funds for four years. The analyst is currently evaluating the impact of various default scenarios to estimate future asset liquidity. The analyst has estimated that the forward probability of default of the B-rated bond is 7.7% in Year 1; 7.1% in Year 2; 6.6% in Year 3; and 6.1% in Year 4. What is the probability that the bond survives for 3 years and then defaults during Year 4?

- A. 4.9%
- B. 5.7%
- C. 6.1%
- D. 6.9%

Q-16. Which of the following statements is not accurate in regard to describing a good rating system?

- A. A verifiable rating system requires backtesting default probabilities on a continuous basis.
- B. An objective rating system results in ratings that can be compared across customer types and market segments.
- C. A specific rating system accurately measures the distance from a default event.
- D. A homogeneous rating system provides judgments required comparable ratings among customer types, market segments, and portfolios

2.5. Key Point: Using Spread to price Default Risk

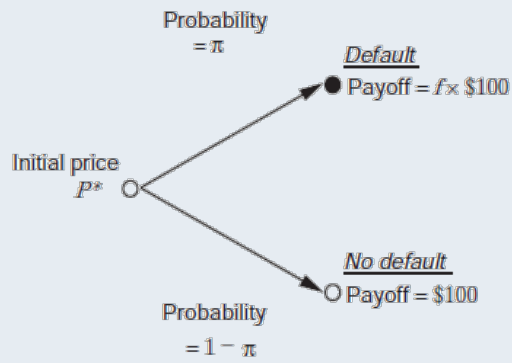
2.5.1. 重要知识点

2.5.1.1. Using Spread to price Default Risk

$$p = \frac{\$1}{1 + \text{YTM}} = \frac{\$1 \times \text{PD} \times \text{RR} + \$1 \times (1 - \text{PD})}{(1 + R_f)}$$

$$\Rightarrow \text{PD} = \frac{1}{\text{LGD}} \left[\frac{\text{YTM} - R_f}{1 + \text{YTM}} \right]$$

$$\Rightarrow \text{YTM} - R_f \approx \text{PD} \times \text{LGD}$$



- Credit spread is the difference between the yield on a risky bond (e.g., corporate bond) and the yield on a risk-free bond (e.g., T-bond) given that the two instruments have the same maturity.

2.5.2. 基础题

Q-17. Consider a 1-year maturity zero-coupon bond with a face value of USD 1,000,000 and a 0% recovery rate issued by Company A. The bond is currently trading at 80% of face value. Assuming the excess spread only captures credit risk and that the risk-free rate is 5% per annum, the risk-neutral 1-year probability of default on Company A is closest to which of the following?

- A. 2%
- B. 14%
- C. 16%
- D. 20%

Q-18. Suppose that you want to estimate the implied default probability for a BB-rated discount corporate bond.

- The T-bond (a risk-free bond) yields 12% per year.
- The one-year BB-rated discount bond yields 15.8% per year.
- The two-year BB-rated discount bond yields 18% per year.

If the recovery rate on a BB-rated bond is expected to be 0%, and the marginal default probability in year one is 5%, which of the following is the best estimate of the risk-neutral probability that the BB-rated discount bond defaults within the next two year?

- A. 6.85%
- B. 3.28%
- C. 9.91%
- D. 10.14%

Q-19. Given the following information, what is the probability of default for this zero- coupon bond that matures in one year?

Face value of bond	\$100
Market price of bond	\$86
Risk-free rate	5%

- A. 9.70%.
- B. 30.71%.
- C. 10.74%.
- D. 35.21%.

Q-20. Suppose XYZ Corp. has two bonds paying semiannually according to the following table. The recovery rate for each in the event of default is 50%. For simplicity, assume that each bond will default only at the end of a coupon period. The market-implied risk-neutral probability of default for XYZ Corp. is

Remaining Maturity	Coupon(30/360)	Price	T-bill rate
6 months	8%	99	5.5%
1 year	9%	100	6%

- A. Greater in the first six-month period than in the second
- B. Equal between the two coupon periods
- C. Greater in the second six-month period than in the first
- D. Cannot be determined from the information provided

Q-21. The spread on a one-year BBB rated bond relative to the risk-free treasury of similar maturity is 2%. It is estimated that the contribution to this spread by all non-credit factors (e.g., liquidity risk, taxes) is 0.8%. Assuming the loss given default rate for the underlying credit is 60%, what is approximately the implied default probability for this bond?

- A. 3.33%
- B. 5.00%
- C. 3.00%
- D. 2.00%

Q-22. The risk-neutral default probability of a one-year corporate BB-rated bond is 5% with an estimated loss given default (LGD) of 65% while the risk-free rate is 2%. If we assume an annual compound frequency, which is nearest to the yield of the corporate bond?

- A. 3.57%

- B. 4.29%
- C. 5.43%
- D. 6.60%

Q-23. A risk manager has asked a junior analyst to estimate the implied default probability for a BBB-rated discount corporate bond. Relevant information on other fixed-income securities are given below:

- The T-bond (a risk-free bond) yields 3% continuously compounding per year constantly.
- The one-year BBB-rated discount bond yields 5% continuously compounding per year.
- The two-year BBB-rated discount bond yields 8% continuously compounding per year.
- The three-year BBB-rated discount bond yields 9% continuously compounding per year.

If the recovery rate on that BBB-rated bond is expected to be 0%, which of the following is the best estimate of the risk-neutral probability that the BBB-rated discount bond defaults within the next three years?

- A. 6.31%
- B. 7.27%
- C. 12.22%
- D. 16.47%

2.6. Key Point: Merton Model

2.6.1. 重要知识点

2.6.1.1. Merton Model

- Equity
 - Equity is a call option on the firm value with strike price equal to the face value of debt.
- Risky Bond
 - Value of Risky Debt = Risk-Free Bond - put on Firm
- Merton Model
 - $\text{Equity} = VN(d_1) - Ke^{-rT}N(d_2)$
 - $\text{Debt} = Ke^{-rT} - \text{put} = VN(-d_1) + Ke^{-rT}N(d_2)$
 - $d_{1,2} = \frac{\ln(V/Ke^{-rT})}{\sigma\sqrt{T}} \pm \frac{\sigma\sqrt{T}}{2}$
 - V: firm value

- K:face value of debt

➤ Risk-Neutral vs. Real World

2.6.2. 基础题

- Q-24.** A firm has an asset value of \$110 million with asset volatility of 30% per annum. Its only debt is a zero-coupon bond with face value of \$80 million that matures in five years. The risk-free rate is 4%. The Black-Scholes Merton price of a put option on the firm's assets with strike price equal to the face value of the bond is \$6.95 million. Which is nears to the current value of the firm's debt.
- A. \$6.95 million
 - B. \$41.30 million
 - C. \$58.55 million
 - D. \$65.50 million
- Q-25.** Suppose a firm has two debt issues outstanding. One is a senior debt issue that matures in three years with a principal amount of \$100 million. The other is a subordinate debt issue that also matures in three years with a principal amount of \$50 million. The annual interest rate is 5%, and the volatility of the firm value is estimated to be 15%. If interest rates decline in the Merton model, then which of the following is true?
- A. If the firm is experiencing financial distress (low firm value), then the value of senior debt will increase while the values of subordinate debt and equity will both decline.
 - B. If the firm is not experiencing financial distress (high firm value), then the value of senior debt and subordinate debt and equity will increase.
 - C. If the firm is experiencing financial distress (low firm value), then the value of senior debt and subordinate debt will increase while equity values will decline.
 - D. If the firm is not experiencing financial distress (high firm value), then the value of senior debt will increase while the values of subordinate debt and equity will both decline.
- Q-26.** In the following things about Merton model, which of the statement is true?
- A. In Merton model the payment to debt holder can be seen as the payoff of a riskless bond plus a put on the value of the firm.
 - B. The sudden surprise (a jump), leading to an unexpected default can be captured by the by this model.
 - C. The model can take into account the default prior to the maturity of debt, when a borrower claims so.

- D. The value of the firm is difficult to pin down cause the market-to-market value of debt is often unknown. .

Q-27. Consider a firm with current asset value of \$20 billion, asset volatility of 35% per annum, short-term liabilities of \$12 billion and long-term liabilities of \$6 billion. The expected return on the firm's assets is 12% and the risk-free rate is 1%. Finally, the firm does not pay dividends and the credit horizon is 1 year. If the strike price default point is the sum of short-term debt plus one-half of long-term debt, what is the Merton physical probability of default in one year?

- A. 10.11%
B. 12.11%
C. 14.11%
D. 16.11%

z	P(Z < z)	z	P(Z < z)	z	P(Z < z)
-1.50	0.0668	-1.00	0.1587	-0.50	0.3085
-1.49	0.0681	-0.99	0.1611	-0.49	0.3121
-1.48	0.0694	-0.98	0.1635	-0.48	0.3156
-1.47	0.0708	-0.97	0.1660	-0.47	0.3192
-1.46	0.0721	-0.96	0.1685	-0.46	0.3228
-1.45	0.0735	-0.95	0.1711	-0.45	0.3264
-1.44	0.0749	-0.94	0.1736	-0.44	0.3300
-1.43	0.0764	-0.93	0.1762	-0.43	0.3336
-1.42	0.0778	-0.92	0.1788	-0.42	0.3372

Q-28. The capital structure of HighGear Corporation consists of two parts: one 5-year zero-coupon bond with a face value of USD 100 million and the rest is equity. The current market value of the firm's asset (MVA) is USD 130 million and the risk-free rate is 25%. The firm's assets have an annual volatility of 30%. Assume that firm value is log-normally distributed with constant volatility. The firm's risk management division estimates the distance to default (in terms of number of standard deviations) using the Merton Model,

Given the distance to default, the estimated risk-neutral default probability is $N(1.9191) = 0.9724$):

- A. 2.74%
B. 12.78%
C. 12.79%

D. 30.56%

Q-29. A firm has a value of \$400 million with expected return of 14% per annum and volatility of 36% per annum. The firm's only debt is a short-term zero-coupon bond with face value of \$300 million due in one year. The riskless rate is 4%. Which is nearest to the firm's (normal returns-based) distance to default when deriving the physical PD?

- A. 1.0
- B. 2.7
- C. 3.3
- D. 8.5

Q-30. A credit risk analyst has estimated the probability of a particular firm defaulting in the next year to be 1.25% using the Merton model. The risk analyst used his bank's definition of the default threshold, namely that default occurs when the firm's value falls below the value of its short term debt plus half the value of its long term debt. Suppose the bank switched from using the Merton model to using the KMV approach to estimate default risk with the following historical expected default frequency buckets ($N(-2.24) = 1.25\%$):

Distance-to-Default	Expected Default Frequency
< -4	0.3%
-4 to -3	0.3%
-3 to -2.5	0.6%
-2.5 to -2.0	1.6%
-2.0 to -1.6	3.8%
-1.6 to -1.2	8.3%
-1.2 to -0.9	14.9%
-0.9 to -0.6	22.7%

What would the new default probability be?

- A. 0.3%
- B. 1.6%
- C. 2.8%
- D. 3.8%

Q-31. Analyst Greg is employing the Merton model to both value a firm's equity and estimate a physical default probability. He has collected the following information:

- The firm's default threshold one year forward is \$10 million; e.g., face value of

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short-term debt is \$10 million.

- The firm current asset value is \$12.75 million with an expected return of 8% per annum with continuous compounding
- The volatility of the firm's assets is 9.6%
- The risk-free rate is 2%

His exercise includes two components: one, valuation of the firm's equity market value by treating equity as a call option on the firm's assets; two, estimate of default probability by calculation of a forward distance to default. Greg makes two assumptions:

- I. An increase in the risk-free rate will increase an estimate of the firm's current equity market value, and
- II. An increase in the risk-free rate will decrease the estimated default probability.

Which of Greg's two assumptions is correct?

- A. Neither
- B. I only
- C. II only
- D. Both

- Q-32.** A credit manager in the counterparty risk division of a large bank uses a simplified version of the Merton model to monitor the relative vulnerability of its largest counterparties to changes in their valuation and financial conditions. In order to assess the risk of default of three particular counterparties, the manager calculates the distance to default assuming a 1-year horizon ($t = 1$). The counterparties: Company P, Company Q, and Company R, belong to the same industry. Selected information on the companies is provided in the table:

Company	P	Q	R
Market value of asset (EUR million)	100	150	250
Face value of debt (EUR million)	60	100	160
Annual volatility of asset values	10.0%	7.0%	8.0%

Using the information above with the assumption that short-term debt is the only liability for each company, and the approximation formula of the distance to default, what is the correct ranking of the counterparties, from most likely to least likely to default?

- A. P; R; Q
- B. Q; P; R
- C. Q; R; P
- D. R; Q; P

Q-33. A gold mining company has outstanding option-less zero-coupon bonds with a face value of \$100 million and a current market value of \$95 million. The company's bonds mature in 3 years. Treasury notes with same maturity have a continuously compounded yield of 1.5% per year. What is the average credit spread of the company's bonds?

- A. 0.21%
- B. 2.07%
- C. 2.19%
- D. 3.43%

2.7. Key Point: Moody – KMV Model

2.7.1. 重要知识点

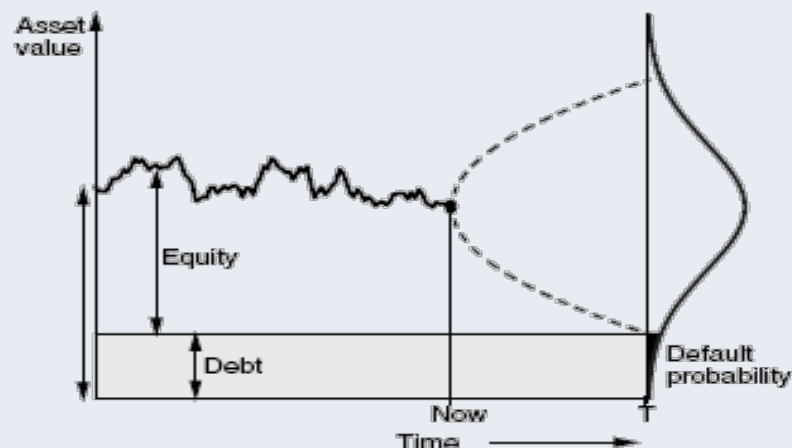
2.7.1.1. Moody – KMV Model

- The normalized distance to default (DD)

$$DD = \frac{A - K}{\sigma_A}$$

Where: K is the value of liabilities:

K = short-term liabilities + 0.5×long-term liabilities.



2.7.2. 基础题

Q-34. An analyst is using Moody's KMV model to estimate the distance to default of a large public firm, Shoos Inc., a firm that designs, manufactures and sells athletic shoes. The firm's capital structure consists of USD 40 million in short-term debt, USD 20 million in long-term debt, and there are one million shares of stock currently trading at USD 10 per share. The asset volatility is 20% per year. What is the normalized distance to default for Shoos Inc.?

- A. 0.714

- B. 1.430
- C. 2.240
- D. 5.000

Q-35. You are given the following information about firm A:

- Market value of asset at time 0 = 1000
- Market value of asset at time 1 = 1200
- Short-term debt = 500
- Long-term debt = 300
- Annualized asset volatility = 10%

According to KMV model, what are the default point and the distance to default at time 1?

	<u>Default Point</u>	<u>Distance to Default</u>
A.	800	3.33
B.	650	7.50
C.	650	4.58
D.	500	5.83

Q-36. Each of the following is true about the KMV model except which is false?

- A. Unlike Merton, which assume the default threshold is total debt, KMV's default threshold falls between short-term and total (short-term + long-term) debt.
- B. Similar to the Merton model, the KMV approach requires an estimate of asset volatility and future asset value in order to calculate distance to default as a number of standard deviations.
- C. Similar to the Merton model, the KMV approach models distance to default (DD) = (asset market value – default threshold)/(asset market value × asset volatility)
- D. Similar to the Merton model, the KMV approach assumes the future asset value is lognormal such that asset (log) returns are normal with EDF = N(DD)

2.8. Key Point: Poisson distribution and Exponential distribution

2.8.1. 重要知识点

2.8.1.1. Poisson distribution and Exponential distribution

- Poisson distribution: 用来刻画违约个数的概率分布
- Exponential distribution: 用来刻画到下一次违约所用时间的概率分布
- Hazard Rates
 - The hazard rate (default intensity) is represented by the (constant) parameter λ and the probability of default over the next, small time interval, dt , is λdt .

➤ Cumulative PD

- If the time of the default event is denoted t^* , the cumulative default time distribution $F(t)$ represents the probability of default over $(0, t)$:

$$P(t^* < t) = F(t) = 1 - e^{-\lambda t}$$

- The survival distribution is:

$$P(t^* \geq t) = 1 - F(t) = e^{-\lambda t}$$

2.8.2. 基础题

Q-37. Given a hazard rate of 0.15, find the probability when a company defaults in year two given surviving the first year.

- A. 0.1393
- B. 0.2592
- C. 0.7408
- D. 0.8607

Q-38. Peter the municipal bond analyst observes that in recent years there have occurred only about 6 U.S. municipal defaults per year. If he makes the highly simplifying assumption that 6 defaults per year is the average in a Poisson process (distribution), what is the probability that the next municipal default will occur within one month?

- A. 8.42%
- B. 17%
- C. 39.35%
- D. 60.65%

Q-39. Suppose the hazard rate is constant and equal to 0.090. In this case, each of the following is true except which is false?

- A. The unconditional one-year default probability is 8.6%
- B. The unconditional two-year default probability is 16.5%
- C. The probability of joint event of survival through the first year and default in the second year is 7.9%
- D. The conditional one-year default probability, given survival through the first year, is 17.3%

Q-40. An analyst estimates that the hazard rate for a company is 0.1 per year. The probability of survival in the first year followed by a default in the second year is closest to:

- A. 8.61%

- B. 9.00%
- C. 9.52%
- D. 19.03%

2.9. Key Point: Single – Factor Model

2.9.1. 重要知识点

2.9.1.1. Single – Factor Model

$$\alpha = \beta m + \sqrt{1 - \beta^2} \varepsilon$$

$$E(\alpha) = 0; \text{Var}(\alpha) = \beta^2 + 1 - \beta^2 = 1$$

➤ Conditional cumulative default probability function:

$$p = \Phi \left(\frac{K_i - \beta_i \bar{m}}{\sqrt{1 - \beta_i^2}} \right) \quad i = 1, 2, \dots$$

2.9.2. 基础题

Q-41. Under single-factor model, a firm has a beta of 0.40 and an unconditional default probability of 1%. If we enter a modest economic downturn, such that the value of $m = -1.0$, what is the conditional default probability?

- A. 1.0%
- B. 1.8%
- C. 2.5%
- D. 2.8%

Q-42. The default correlation under a single-factor credit model is 4.9%. Both credits have the same individual default probabilities of 2%. The joint default probability is characterized by a bivariate standard normal distribution. Below listed the asset correlations implied by various joint default probabilities. What is the implied asset correlation?

Asset Correlation	Joint Default Probability
-	0.040%
0.05	0.053%
0.10	0.069%
0.15	0.040%
0.20	0.110%
0.25	0.136%

- A. 0.1
- B. 0.15
- C. 0.2

2.10. Key Point: Credit Exposure

2.10.1. 重要知识点

2.10.1.1. Current Exposure (Replacement Cost)

- Larger of zero and the market value of a transaction or portfolio of transactions within a netting set, with a counterparty that would be lost upon the default of the counterparty, assuming no recovery on the value of those transactions in bankruptcy.

2.10.1.2. Expected Exposure

- The mean (average) of the distribution of exposures at any particular future date before the longest-maturity transaction in the netting set matures.

2.10.1.3. Expected Positive Exposure (EPE)

- The weighted average over time of expected exposures where the weights are the proportion that an individual expected exposure represents of the entire time interval.

2.10.1.4. Negative Exposure

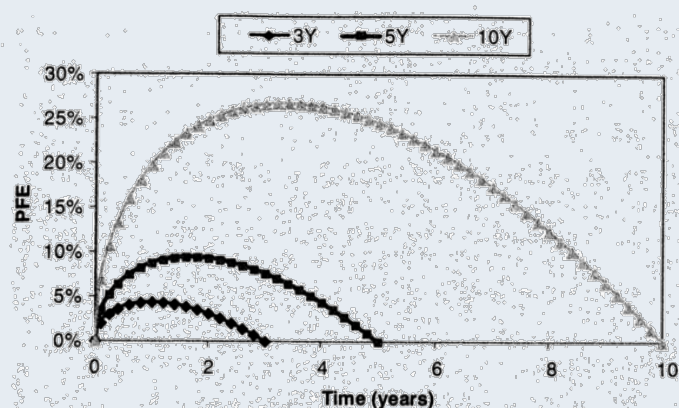
- The exposure from a counterparty's point of view. Define measures such as negative expected exposure (NEE) and expected negative exposure (ENE), which are the precise opposite of EE and EPE.

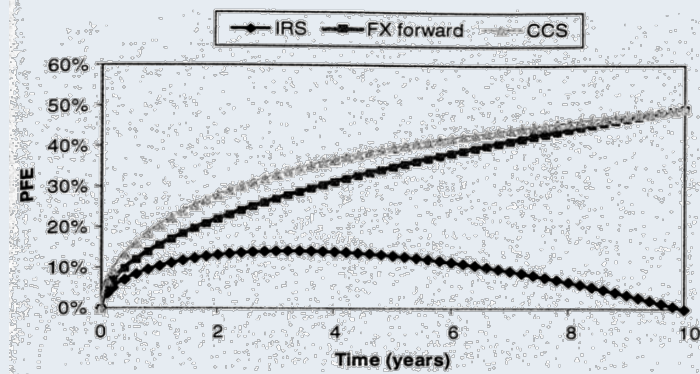
2.10.1.5. Peak Exposure/Potential Future Exposure

- A high-percentile (typically 95% or 99%) of the distribution of exposures at any particular future date before the maturity date of the longest transaction in the netting set.

2.10.1.6. Maximum PFE

- Represents the highest PFE value over a given time interval, thus representing the worst-case exposure over the entire interval.

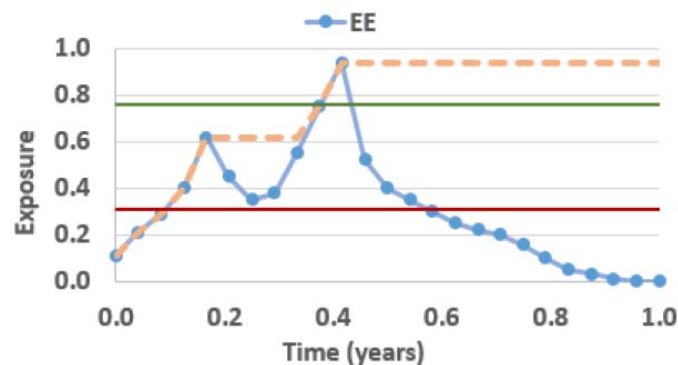




2.10.2. 基础题

- Q-43.** Which of the following statements regarding exposure measures is not accurate?
- A. Assuming no recovery in bankruptcy, current exposure is the greater of zero and the market value of a transaction or portfolio of transactions that the investor would be lost when a counterparty defaulted.
 - B. Potential Future Exposure measures the distribution of exposures of low percentile.
 - C. Expected exposure measures the mean distribution of exposures at a given future date prior to the maturity of the longest maturity exposure in the netting group.
 - D. The weights of expected positive exposure could represent the proportion that an individual expected exposures of the entire time interval.
- Q-44.** If a counterparty defaults before maturity, which of the following situations will cause a credit loss?
- A. You are short Euros in a one-year euro/USD forward FX contract, and the euro has appreciated.
 - B. You are short Euros in a one-year euro/USD forward FX contract, and the euro has depreciated.
 - C. You sold a one-year OTC euro call option, and the euro has appreciated.
 - D. You sold a one-year OTC euro call option, and the euro has depreciated.
- Q-45.** Suppose a mark-to-market (MtM) is defined by a normal distribution with mean of 2% and standard deviation of 5%. Each of the following is true about the expected exposure except which is false?
- A. The EE is greater than 2%
 - B. The EE is greater than the 95% confident potential future exposure (PFE)
 - C. An increase in the mean assumption will increase the EE.
 - D. An increase in the standard deviation assumption will increase the EE.

- Q-46.** Each of the following is true except:
- A. At any point in time, effective EE cannot be less than EE
 - B. (effective) EPE is average (effective) EE over time
 - C. Effective EPE cannot be less than EPE
 - D. For each point in time, there is a different maximum PFE such that maximum PFE does not represent a single value
- Q-47.** Paul sells a put option on HRTB stock with a time to expiration of six months, a strike price of USD 125, and underlying asset price of USD 98, implied volatility of 20% and a risk-free rate of 4%. What is Paul's counterparty credit exposure from this transaction?
- A. USD 0.00
 - B. USD 0.38
 - C. USD 1.75
 - D. USD 24.90
- Q-48.** Refer to the chart below, which plots four lines over time.



Which of the following does the uppermost line most likely represent?

- A. Effective expected exposure.
 - B. Expected positive exposure.
 - C. Potential future exposure.
 - D. Maximum potential future exposure.
- Q-49.** Assume that swap rates are identical for all swap tenors. A swap dealer entered into a plain-vanilla swap one year ago as the receive-fixed party, when the price of the swap was 7%. Today, this swap dealer will face credit risk exposure from this swap only if the value of the swap for the dealer is
- A. Negative, which will occur if new swaps are being priced at 6%

- B. Negative, which will occur if new swaps are being priced at 8%
- C. Positive, which will occur if new swaps are being priced at 6%
- D. Positive, which will occur if new swaps are being priced at 8%

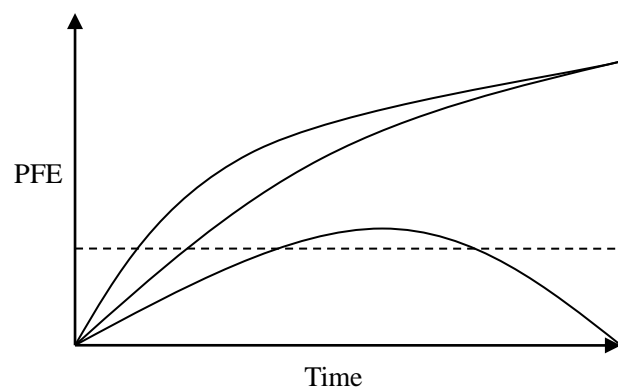
Q-50. Which one of the following deals would have the greatest credit exposure for a \$1,000,000 deal size (assume the counterparty in each deal is an AAA-rated bank and has no settlement risk)?

- A. Pay fixed in an Australian dollar (AUD) interest rate swap for one year.
- B. Sell USD against AUD in a one-year forward foreign exchange contract.
- C. Sell a one-year AUD cap.
- D. Purchase a one-year certificate of deposit.

Q-51. BNP Paribas has just entered into a plain-vanilla interest-rate swap as a pay-fixed counterparty. Credit Agricole is the receive-fixed counterparty in the same swap. The forward spot curve is upward-sloping. If LIBOR starts trending down and the forward spot curve flattens, the credit risk from the swap will:

- A. Increase only for BNP Paribas
- B. Increase only for Credit Agricole
- C. Decrease for both BNP Paribas and Credit Agricole
- D. Increase for both BNP Paribas and Credit Agricole

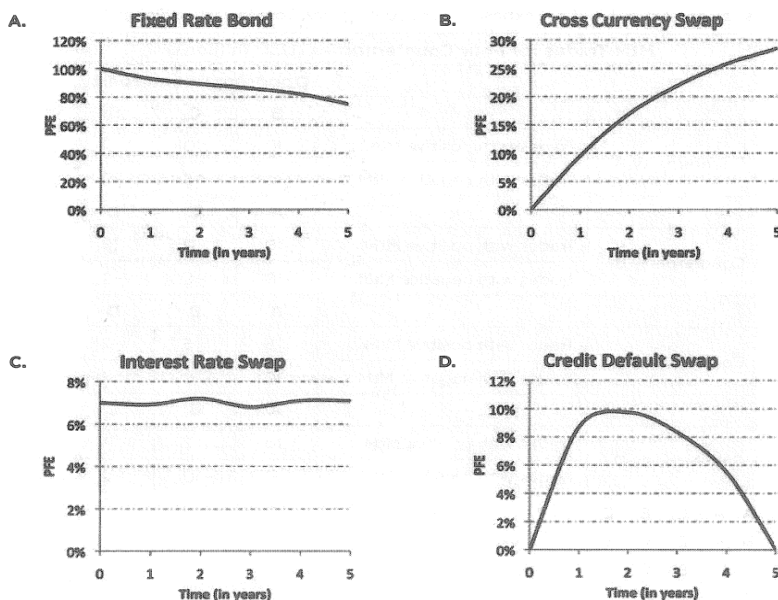
Q-52. The chart below shows three exposure profiles, where the exposure metric is the potential future exposure (PFE): PFE of an interest rate swap (IRS), PFE of a foreign exchange (FX) forward contract, and PFE of a cross-currency swap. Also plotted is the average PFE of the interest rate swap, where "average PFE" is what Jorion calls the average worst credit exposure (AWCE). Which position's (instrument's) exposure profile is most likely the uppermost, concave plot line?



- A. PFE of interest rate swap

- B. PFE of foreign exchange (FX) contract
- C. PFE of cross-currency swap
- D. Average PFE of interest rate swap

Q-53. Which of the following graphs is an accurate representation of a typical potential future exposure (PFE) profile for the corresponding instrument?



Q-54. Six months ago, Textile Manufacturing Inc. (TMI) entered into a 9-month forward contract with Spin Mills Company (SMC) to purchase 36,000 tons of yarn. At the time the forward was entered into, 36,000 tons of yarn was priced at EUR 92.0 million but is currently priced at EUR 94.0 million. The continuously compounded risk-free rate has remained stable at 3.0% per year and is not expected to change during the entire contract period. Assuming the forward is fairly priced, what is the current potential credit risk exposure on the forward contract and who bears the risk?

- A. EUR 0.610 million; TMI bears the potential credit risk
- B. EUR 0.610 million; SMC bears the potential credit risk
- C. EUR 1.308 million; TMI bears the potential credit risk
- D. EUR 1.308 million; SMC bears the potential credit risk

2.11. Key Point: Credit Value Adjustment (CVA)

2.11.1. 重要知识点

2.11.1.1. Credit Value Adjustment (CVA)

- CVA is the expected value or price of counterparty credit risk. A positive value represents a cost to the counterparty that bears a greater propensity to default.

$$CVA = LGD \sum_{i=1}^m EE(t_i) \times PD(t_{i-1}, t_i)$$

$$CVA = EPE \times \text{Spread}$$

➤ Incremental and Marginal CVA

- Incremental CVA calculates the cost of a new trade versus an existing one to determine the effect that the new trade has on CVA. The formula is identical to stand-alone CVA, except for the use incremental expected exposure.
- Marginal CVA is used for trade level attribution. The formula is identical to stand-alone CVA, except for the use of marginal expected exposure.

➤ Stress Test on a Loan Portfolio

$$EL_s = \sum_{i=1}^N PD_i^s \cdot EAD_i \cdot LGD_i$$

$$EL_s - EL$$

➤ Stress Test on Derivative Portfolio

$$EL = \sum_{i=1}^N PD_i \cdot \alpha \cdot EPE_i \cdot LGD_i$$

$$EL_s = \sum_{i=1}^N PD_i^s \cdot \alpha \cdot EPE_i^s \cdot LGD_i$$

➤ Stressed CVA and Stress Loss on CVA

$$CVA^s = \sum_{n=1}^N LGD_n \cdot \sum_{i=1}^m EE_n^s(t_i) \cdot PD_n^s(t_{i-1}, t_i)$$

2.11.2. 基础题

Q-55. With respect to the CVA calculation, which of the following statement is correct when a risk manager wishes to understand which trades have the greatest impact on a counterparty's CVA? The manager would use:

- Incremental CVA because it accounts for the change in CVA once the new trade is priced, accounting for netting.
- Marginal CVA because he could break down netted trades into trade level contributions.
- Incremental CVA because he could break down netted trades into trade level contributions.
- Marginal CVA because it accounts for the change in CVA once the new trade is priced,

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accounting for netting.

Q-56. A risk manager needs a quick calculation of the BCVA on a swap. Assume inputs are as follows: EPE = 5%, ENE = 3%, counterparty credit spread = 300bps, financial institution credit spread = 200 bps. Compute BCVA from the perspective of the financial institution.

- A. -1
- B. 1
- C. 9
- D. -9

Q-57. A bank enters into a swap agreement with a counterparty. The swap has no collateral requirements, and no netting agreements are present between the bank and the counterparty. The following data is available for the swap position:

- The counterparty expected exposure is 0.40% and approximately constant from month to month.
- The credit spread for a five year credit default swap on the counterparty is 500 bps.
- The counterparty's probability of default within five years is 10%.
- The 5-year effective duration of the swap is 4.0.

Assuming no wrong-way risk on the position, which value is the closest approximation of the credit value adjustment expressed as a running spread?

- A. 2 bps
- B. 4 bps
- C. 5 bps
- D. 8 bps

Q-58. Mary assigns to John a long position in an at-the-money (ATM) call option with a one year term and strike a price of \$100.00. The current stock price is \$100.00 with volatility of 60.0%. The risk-free rate is 3.0% with continuous compounding. $N(d_1) = 0.64$ and $N(d_2) = 0.40$. The present-valued expected exposure (EE) to the counterparty, who holds the short option position, is \$23.00 with a probability of counterparty default of 5.0% and loss given default (LGD) of 75.0%. Which is nearest to John's payment for the long option position, if his cost includes a credit valuation adjustment (CVA)?

- A. \$6.15
- B. \$19.37
- C. \$24.32

D. \$26.04

Q-59. Sam prices a put option on an asset with the Black-Scholes-Merton option pricing model and calculates a model premium of \$25. This \$25 also coincidentally equals the present-valued expected exposure faced by Sam with respect to the short option position. Sam estimates the probability of counterparty default by the option writer to be 10% with loss given default of 40%, such that the expected loss = $\$25 \text{ EE} \times 10\% \text{ PD} \times 40\% \text{ LGD} = \1 . He concludes that the CVA-adjusted (net of counterparty risk) option price is \$24. His colleague Jane observes that this calculation assumes no wrong-way risk. But there is a high, positive correlation between underlying asset price and the credit quality of the option writer counterparty: both the counterparty and underlying share a sector that reacts to the same common factors such that adverse economic regimes depress sector asset prices while lowering sector credit quality (and increasing credit spreads). Is Jane correct that the CVA-adjusted option value deserves further adjustment?

- A. As the correlation is positive, this is instead right-way risk; but the true CVA-adjusted value remains \$24 as there is no adjustment for right-way risk.
- B. As the correlation is positive, this is instead right-way risk; therefore, the true CVA-adjusted value will be higher than \$24.
- C. Jane is correct that this is wrong-way risk; therefore, true CVA-adjusted value will be lower than \$24.
- D. Jane is correct that this is wrong-way risk but expected loss is not impacted by correlation, so Sam correctly has the CVA-adjusted value at \$24.

Q-60. Local Company, a frequent user of swaps, often enters into transactions with Global Bank, a major provider of swaps. Recently, Global Bank was downgraded from a rating of AA+ to a rating of A, while Local Company was downgraded from a rating of A to a rating of A-. During this time, the credit spread for Global Bank increased from 20 bps to 150 bps. While the credit spread for Local Company increased from 130 bps to 170 bps. Which of the following is the most likely action that the counterparties will request on their credit value adjustment (CVA)?

- A. The credit qualities of the counterparties have changed, but not enough to justify amending existing CVA arrangements.
- B. Global Bank requests an increase in the CVA charge it receives.
- C. Local Company requests a reduction in the CVA charge it pays.
- D. CVA is no longer a relevant factor, and the counterparties will use other mitigants of counterparty risk.

Q-61. An investor said: “The formula for BCVA is similar to the formula for CVA, except that the BCVA formula incorporates the probability of the counterparty's survival and uses EPE.” Which of the following statements is accurate?

- A. The statement is correct with regard to EPE only.
- B. The statement is correct with regard to probability of survival only.
- C. The statement is incorrect with regard to both EPE and probability of survival.
- D. The statement is correct with regard to both EPE and probability of survival.

Q-62. ADB Banking Corporation (ADB) often enters into interest rate swaps with HIP Bank (HIP) on terms that reflect appropriate counterparty risk. Earlier in the year, HIP and ADB entered into a 3-year swap in which ADB agreed to pay HIP 5% fixed in return for 6-month LIBOR plus a spread. Since the swap was entered into, both banks were downgraded. As a result of the ratings changes, the credit spread for HIP has increased from 36 bps to 144 bps, while the credit spread for ADB has increased from 114 bps to 156 bps. Assuming no change in the LIBOR curve, if an identical 3-year swap was entered into today, which of the following is the most likely to be correct?

- A. Since HIP's spread increased more than ADB's spread, HIP's DVA will be higher and ADB's DVA will be lower.
- B. Since HIP's spread increased more than ADB's spread, HIP's CVA will be higher and ADB's CVA will be lower.
- C. Since both banks' spreads increased, the CVA on both sides of the contract will be higher.
- D. Since both banks' spreads increased, the DVA on both sides of the contract will be lower.

Q-63. A CRO at an investment bank has asked the risk department to evaluate the bank's 3-year derivative exposure position with a counterparty. The 1-year CDS on the counterparty is currently trading at a spread of 180 bps. The table below presents trade and forecast data on the CDS spread, the expected exposure, and the recovery rate on the counterparty:

	Year 1	Year 2	Year 3
Expected exposure (AUD million)	15	15	15
CDS spread (bps)	180	300	420
Recovery rate (%)	85	75	65

Additionally, the CRO has presented the risk team with the following set of assumptions to use in conducting the analysis:

- The counterparty's time-to-default follows a distribution of constant hazard rate.
- The investment bank and the counterparty have signed a credit support annex (CSA) to cover this exposure, which requires collateral posting of AUD 13 million throughout the life of the contract
- The current risk-free rate of interest is 2% and the term structure of interest rates remains flat over the 3-year horizon
- Collateral and exposure values will remain stable over the life of the contract.

Given the information and the assumptions above, what is the correct estimate for the credit valuation adjustment for this position?

- A. AUD 0.140 million
- B. AUD 0.172 million
- C. AUD 0.442 million
- D. AUD 1.051 million

Q-64. Three months ago, Valtemp Construction Company (VCC) entered into a 9-month forward contract with Millenia Steel Products (MSP) to purchase 6,000 tons of stainless steel from MSP. At the time the forward was entered into, 6,000 tons of stainless steel was priced at EUR 20.3 million but is currently priced at EUR 23.5 million. The continuously compounded risk-free rate has remained stable at 4.0% per year and is not expected to change during the remainder of the contract period. Assuming the forward is fairly priced, what is the current potential credit risk exposure on the forward contract and who bears the risk?

- A. EUR 2.790 million; MSP bears the potential credit risk
- B. EUR 2.790 million; VCC bears the potential credit risk
- C. EUR 2.996 million; MSP bears the potential credit risk
- D. EUR 2.996 million; VCC bears the potential credit risk

2.12. Key Point: Wrong-Way Risk

2.12.1. 重要知识点

2.12.1.1. Wrong-Way Risk: An outcome of any association, dependence, linkage, or interrelationship between exposure and counterparty creditworthiness that generates an overall increase in counterparty risk and, therefore, an increase in the amount of the credit value adjustment (CVA).

2.12.1.2. Right-Way Risk: Any dependence, linkage, or interrelationship between the exposure and default probability of a counterparty producing an overall decrease in counterparty risk is described as right-way risk.

2.12.2. 基础题

- Q-65.** Which of the following activities or transactions would most likely result in right-way risk with counterparty?
- A. Purchasing a put option from an A-rated company on that company's stock.
 - B. Entering Into a forward contract to buy West Texas Intermediate (WTI) crude oil from an airline company at a fixed price
 - C. Entering into a forward contract to buy WTI crude oil from a large oil producer at a fixed price.
 - D. Selling a put option to an A-rated company on that company's stock.

- Q-66.** Bank HJK has written puts on Bank PQR stock to a hedge fund and sold CDS protection on Bank PQR to a manufacturer. Bank HJK and Bank PQR operate in several of the same businesses and geographies and their performances are highly correlated. Many in the market are concerned that rising interest rates could negatively impact the credit quality of Bank HJK's numerous borrowers, which in turn would increase the credit spread of Bank HJK. From the perspectives of the hedge fund and the manufacturer, which of the following is correct with respect to their counterparty risk exposure to Bank HJK?

Hedge Fund	Manufacturer
------------	--------------

- | | |
|-------------------|----------------|
| A. Right-way risk | Wrong-way risk |
| B. Wrong-way risk | Right-way risk |
| C. Right-way risk | Right-way risk |
| D. Wrong-way risk | Wrong-way risk |
- Q-67.** A hedge fund manages a portfolio of equity options. Among them are options written by a financial institution on its own stock. Assuming that all of the following options have the same expiration date and each of them corresponds to 1 share of the underlying stock of that financial institution, which of the long position in those options would give the highest wrong-way risk to the hedge fund?
- A. An in-the-money call option
 - B. An in-the-money put option
 - C. An out-of-the-money call option
 - D. An out-of-the-money put option

2.13. Key Point: Mitigation of Counterparty Risk

2.13.1. 重要知识点

2.13.1.1. Mitigation of Counterparty Risk

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- Netting Arrangement
- Collateralization
 - Remargin period: the time between the call for collateral and its receipt.
 - Threshold: an exposure level below which collateral is not called. It represents an amount of uncollateralized exposure.
 - Minimum transfer amount: the minimum quantity or block in which collateral may be transferred. Quantities below this amount represent uncollateralized exposure.
 - Independent amount: an amount posted independently of any subsequent collateralization. This is also referred to as the initial margin.
- Contract Clauses
 - Close Out
 - Walkaway
 - Acceleration
 - Termination
- Central Counterparties
 - Loss waterfall: Losses are first absorbed by the defaulted member's initial margin and reserve contributions. If losses are greater, the CCP equity and survivor members' reserves and equity are used.
 - Initial Margin: beginning deposit required from all CCP members to cover future potential default losses in a worst-case scenario; Variation margin: an additional margin for daily changes in asset positions.
- Hedging

2.13.2. 基础题

Q-68. A financial institution has many open derivative positions with an investment company.

A description and current market values are displayed in the table below:

Position	Price (USD)
Long swaptions	32 million
Long credit default swaps	12 million
Short currency derivatives	16 million
Short interest rate swaps	8 million

In the event that the investment company defaults, what would be the loss to the financial institution if netting is used compared to the loss if netting is not used?

- A. Loss of USD 20 million if netting is used; loss of USD 24 million if netting is not used
- B. Loss of USD 20 million if netting is used; loss of USD 44 million if netting is not used
- C. Loss of USD 24 million if netting is used; loss of USD 32 million if netting is not used
- D. Loss of USD 24 million if netting is used; loss of USD 44 million if netting is not used

- Q-69.** The exhibit below presents a summary of bilateral mark-to-market (MtM) trades for four counterparties. If netting agreements exist between all pairs of counterparties shown, what is the correct order of net exposure per counterparty, from lowest to highest?

MtM Trades for Four Counterparties (USD million)				
		Opposing Counterparty		
		B	C	D
Counterparty A	Trades with positive MtM	10	10	1
	Trades with negative MtM	-10	-5	-10
		A	C	D
Counterparty B	Trades with positive MtM	10	0	10
	Trades with negative MtM	-10	-5	-2
		A	B	D
Counterparty C	Trades with positive MtM	5	5	2
	Trades with negative MtM	-10	0	-1
		A	B	C
Counterparty D	Trades with positive MtM	10	2	1
	Trades with negative MtM	-1	-10	-2

- A. A – C – B – D
- B. A – D – C – B
- C. D – B – C – A
- D. B – C – D – A
- Q-70.** Miven Corp. has two trades outstanding with one of its counterparties. Which of the following scenarios would result in the greatest netting advantage for Miven?
- A. The two trades have strong positive correlation.
- B. The two trades have weak positive correlation.
- C. The two trades are uncorrelated with each other.
- D. The two trades have strong negative correlation.

- Q-71.** The table below illustrates exposures for scenarios involving two trades:

	MtM	
	Trade 1	Trade 2
Scenario 1	25	15
Scenario 2	15	-10

Scenario 3	10	-5
Scenario 4	5	-5
Scenario 5	-5	-10

Which is nearest to the netting factor?

- A. 9.92%
- B. 37.50%
- C. 60.88%
- D. 71.43%

Q-72. A mid-sized investment bank conducts several trades. As part of its risk control, it has entered into netting agreements on 8 equity trade positions with an average correlation of 0.28. The firm believes that it can improve upon the diversification benefit of netting by replacing the current agreement by a judicious choice of number of exposures with a favorable correlation coefficient. Which of the following trade combinations would increase the firm's expected netting benefit the most from the current level?

Trade Combination	Number of Positions	Average Correlation
ABC	4	0.25
LMN	7	0.15
PQR	13	-0.06
TUV	15	-0.04

- A. Trade combination ABC
- B. Trade combination LMN
- C. Trade combination PQR
- D. Trade combination TUV

Q-73. A diversified portfolio of OTC derivatives with a single counterparty currently has a net mark-to-market value of USD 20,000,000 and a gross absolute mark-to-market value (the sum of the value of all positive-value positions minus the value of all negative-value positions) of USD 80,000,000. Assuming there are no netting agreements in place with the counterparty, determine the current credit exposure to the counterparty.

- A. Less than or equal to USD 19,000,000
- B. Greater than USD 19,000,000 but less than or equal to USD 40,000,000
- C. Greater than USD 40,000,000 but less than USD 60,000,000
- D. Greater than USD 60,000,000

Q-74. Assume three counterparties (A, B and C) are entered into bilateral derivative trades with the following net current replacement values: replacement value for A with respect to B = \$10 million (i.e., if closed out immediately, B would owe \$10 million to A); replacement value for B with respect to C = \$10 million; replacement value for C with respect to A = \$10 million. If these positions were immediately novated to central counterparty with multilateral netting, which of the following is implied?

- A. Counterparty exposures among A, B and C are each eliminated to zero; but each will have a \$10 million exposure to the central counterparty.
- B. Counterparty exposures among A, B and C are each eliminated to zero; and each will have zero exposure to the central counterparty.
- C. Counterparty exposures among A, B and C are, in total, reduced from \$30 million to \$10 million; and the central counterparty assumes \$20 million in exposure.
- D. The total exposure is not reduced from \$30 million; it is effectively transferred to the central counterparty.

Q-75. What are the benefits of novation?

- A. Allows both party to walk away from the contract in case of default.
- B. A bilateral contract specifying that upon default, the non-defaulting party nets gains and losses with the defaulting counterparty to a single payment for all covered transactions
- C. Financial market contracts can be terminated upon an event of default prior to the bankruptcy process.
- D. Obligations are amalgamated with others

Q-76. You are the credit risk manager for a bank and are looking to mitigate counterparty credit risk exposure to ABCD, an A-rated firm. Currently your bank has the following derivatives contracts with ABCD:

Contract	Contract Value (HKD)
A	20,000,000
B	30,000,000
C	14,000,000
D	1,000,000

With the information provided, what is the most appropriate credit risk mitigation technique in this case?

- A. Implement a netting scheme
- B. Use credit triggers.
- C. Sell credit default swaps on ABCD

- D. Increase collateral.

Q-77. A financial institution has a two-way collateral support annex (CSA) with a counterparty covering a portfolio valued at JPY 400 million. The margining terms of the collateralized portfolio include a threshold of JPY 180 million, a minimum transfer amount of JPY 30 million, and a margin period of risk of 10 days. Which of the following is correct regarding the size of collateral in mitigating the counterparty risk of the portfolio?

- A. A lower threshold value is equivalent to a larger portion of exposure protected by collateral.
- B. A shorter margin period of risk is equivalent to a smaller portion of exposure protected by collateral.
- C. A lower independent amount is equivalent to a larger portion of exposure protected by collateral.
- D. The protection from collateral specified in the CSA is uniform throughout the life of the exposure profile.

Q-78. An underlying exposure with an effective annual price volatility of 6% is collateralized by a 10-year U.S. Treasury note with an effective price volatility of 8%. The correlation between the exposure and the U.S. Treasury note is zero. Changes in the value of the overall position (the exposure plus collateral) are calculated for a 10-day horizon at a 95% confidence interval. Which of the following would one expect to observe from this analysis?

- A. The presence of collateral increases the current exposure and increases the volatility of the exposure between remargining periods.
- B. The presence of collateral decreases the current exposure, but increases the volatility of the exposure between remargining periods.
- C. The presence of collateral increase the current exposure, but decreases the volatility of the exposure between remargining periods.
- D. The presence of collateral decreases the current exposure and decreases the volatility of the exposure between remargining periods.

Q-79. Rarecom is a specialist company that only trades derivatives on rare commodities. Rarecom and a handful of other firms, all of whom have large notional outstanding contracts with Rarecom, dominate the market for such derivatives. Rarecom management would like to mitigate its overall counterparty exposure, with the goal of reducing it to almost zero. Which of the following methods, if implemented, could best achieve this goal?

- A. Ensuring that sufficient collateral is posted by counterparties.
- B. Diversifying among counterparties.
- C. Cross-product netting on a single counterparty basis.
- D. Purchasing credit derivatives, such as credit default swaps.

Q-80. There are a number of challenges for clearing over-the-counter (OTC) derivative products through a centralized counterparty (CCP). Which of the following statements best summarizes the key challenges for central clearing of OTC derivative products?

- A. Jurisdictional fragmentation, increased counterparty risk, less transparency, and standardization.
- B. Product complexity, illiquid products, presence of wrong-way risk, and lack of standardization.
- C. Illiquid products, jurisdictional fragmentation, presence of wrong-way risk, and legal concerns.
- D. Lack of standardization, increased counterparty risk, increased dependency risk, and less transparency.

Q-81. Setting margin levels and loss reserves are important aspects of mitigating systemic risk through the use of a central counterparty (CCP). Which of the following statements most accurately reflects the calculation of initial margins?

- A. The value at risk (VaR) approach sets appropriate initial margins at the 99% confidence level.
- B. The Standard Portfolio Analysis of Risk (SPAN) is considered the most advanced methodology today in calculating initial margins.
- C. The calculation of the initial margin should be based on volatility, tail risk, and dependency.
- D. Initial margins depend solely on the credit quality of the clearing member.

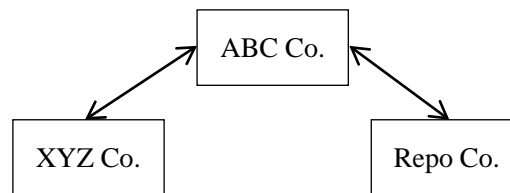
Question 82 AND 83 REFER TO THE FOLLOWING INFORMATION

XYZ, a small investment management firm, specializes in structuring small business loans and selling the government guaranteed portion to other institutional investors while retaining the riskier portions for high net worth investors. XYZ funds its operations by engaging in overnight repurchase agreements (repos) with three firms, but primarily with ABC, a firm that specializes in pooling funds from community banks and local government agencies and investing them in short-term, high-quality, government-secured investments.

Last week, XYZ was informed by ABC that its line had been frozen. XYZ learned that ABC had been defrauded by Repo Co., another repo borrower, who had provided false documentation of

non-existent collateral of government-guaranteed loans. ABC feared a run by its investors as news of the fraud spread.

The diagram below illustrates the parties involved:



Q-82. The use of a central clearinghouse to handle the transactions executed between XYZ's main funding source, ABC and ABC's client, Repo Co., would likely have resulted in a reduction in:

- A. ABC's funding liquidity risk.
- B. Repo Co.'s default risk.
- C. XYZ's lending risk.
- D. ABC's operational risk.

Q-83. By using a clearinghouse to handle the repo transactions between ABC and Repo Co., obligations owned between the two could have been netted once the fraudulent documentation was discovered. Which of the following is the most appropriate type of netting to use in this situation and what would be a likely additional impact from using this netting?

- A. Payment netting would be used, which would reduce ABC's counterparty risk, but this risk would be transferred to other creditors outside the clearinghouse.
- B. Payment netting would be used, which would reduce Repo Co's counterparty risk, but ABC's counterparty risk would be increased.
- C. Closeout netting would be used, which would reduce ABC's counterparty risk, but this risk would be transferred to other creditors outside the clearinghouse.
- D. Closeout netting would be used, which would reduce Repo Co's counterparty risk, but ABC's counterparty risk would be increased.

2.14. Key Point: Credit Derivatives 1 – CDS

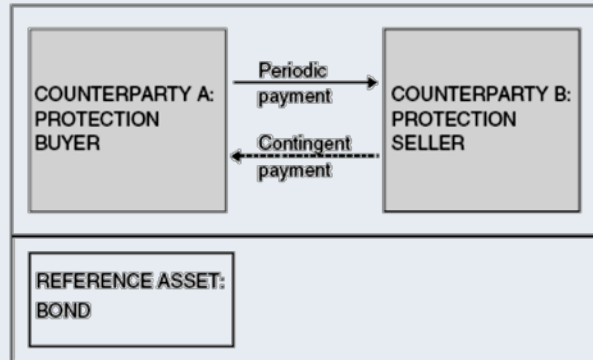
2.14.1. 重要知识点

2.14.1.1. Credit Derivatives 1 – CDS

- In a Credit Default Swaps contract, a protection buyer (say A) pays a premium to the protection seller (say B), in exchange for payment if a credit event occurs.
- A default swap acts like a put option on the reference obligation for the buyer of

the swap. If there is a default, the buyer receives a payment, which limits the buyer's downside risk.

- A long position in a corporate bond is equivalent to a long position in a risk-free bond plus a short position in a credit default swap.



- Settlement:
 - Cash-Settled (Include: Digital)
 - Physically Settled
- Nth to default CDS
 - An nth to default CDS pays off when the nth default occurs in the reference asset portfolio.
 - For this kind of swap, whenever the nth default occurs in the reference basket, the buyer stops paying the premium and receives the difference of the principal amount of the latest (nth) defaulted entity and the recovered value.
- Correlation in Nth to default CDS
 - If the reference assets are perfectly positive correlated, the value of the first-to-default CDS will be the same as the Nth-to-default ($n > 1$) CDS because the number of defaults will likely be either 0 or all assets.
 - If the default correlation is low, small number of defaults is more likely. Therefore, first-to-default is more preferable.
 - When default correlation increase, there is an increased probability of more defaults, and the value of the Nth-to-default ($n > 1$) goes up accordingly.

2.14.2. 基础题

- Q-84.** You are currently long \$10,000,000 par value, 8% XYZ bonds. To hedge your position, you must decide between credit protection via a 5-year CDS with 60bp annual premiums or digital swap with 50% payout with 50bp annual premiums. After one year, XYZ has defaulted on its debt obligations and currently trades at 60% of par. Which of the following statements is true?

- A. The contingent payment from the protection buyer to the protection seller is greater under the single-name CDS than the digital swap.
- B. The contingent payment from the protection buyer to the protection seller is less under the single-name CDS than the digital swap.
- C. The contingent payment from the protection seller to the protection buyer is greater under the single-name CDS than the digital swap.
- D. The contingent payment from the protection seller to the protection buyer is less under the single-name CDS than the digital swap.

Q-85. When an institution has sold exposure to another institution (i.e., purchased protection) in a CDS, it has exchanged the risk of default on the underlying asset for which of the following?

- A. Default risk of the counterparty
- B. Default risk of a credit exposure identified by the counterparty
- C. Joint risk of default by the counterparty and of the credit exposure identified by the counterparty
- D. Joint risk of default by the counterparty and the underlying asset

Q-86. A risk manager is advising the trading desk about entering into a digital credit default swap as a way to obtain credit protection. Which cash flow and delivery requirement will the desk most likely experience in the event of a default of the underlying reference asset?

- A. Receive the pre-agreed cash payment; delivering nothing.
- B. Receive $[(\text{Par Value}) - (\text{Market Value of Reference Asset})]$; deliver the reference asset.
- C. Receive $[(\text{Par Value}) - (\text{Market Value of Reference Asset})]$; deliver nothing.
- D. Receive the pre-agreed cash payment; deliver the reference asset.

Q-87. A six-year CDS on a AA-rated issuer is offered at 150bp with semiannual payments while the yield on a six-year annual coupon bond of this issuer is 8%. There is no counterparty risk on the CDS. The annualized LIBOR rate paid every six months is 4.6% for all maturities. Which strategy would exploit the arbitrage opportunity? How much would your return exceed LIBOR?

- A. Buy the bond and the CDS with a risk-free gain of 1.9%.
- B. Buy the bond and the CDS with a risk-free gain of 0.32%.
- C. Short the bond and sell CDS protection with a risk-free gain of 4.97%.
- D. There is no arbitrage opportunity as any apparent risk-free profit is necessarily compensation for being exposed to the credit risk of the issuer.

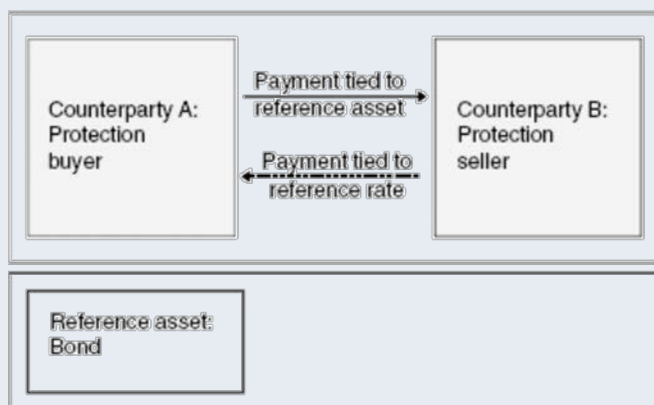
- Q-88.** Which of the following statements concerning credit default swap is correct?
- A. The effective maturity of a CDS is reduced by including a liquidity put in the master agreement.
 - B. To purchase a single-name CDS contract, the buyer must also own the reference asset.
 - C. Typically, there is only one reference asset that can be delivered to satisfy a CDS contract.
 - D. CDS contracts can only be satisfied through cash settlement.

2.15. Key Point: Credit Derivatives 2 – TRS

2.15.1. 重要知识点

2.15.1.1. Credit Derivatives 2 – TRS

- Total Rate of Return Swaps are contracts where one party, called the protection buyer (also called TROR payer and risk seller), makes a series of payments linked to the total return on a reference asset.



2.15.2. 基础题

- Q-89.** Risk Averse Bank (RAB) has made a loan of USD 100 million at 8% per annum. RAB wants to enter into a total return swap under which it will pay the interest on the loan plus the change in the mark-to-market value of the loan, and in exchange, RAB will get LIBOR + 30 basis points. Settlement payments are made annually. What is the cash flow for RAB on the first settlement date if the mark-to-market value of the loan falls by 2% and LIBOR is 6%?
- A. Net inflow of USD 0.3 million
 - B. Net outflow of USD 0.3 million
 - C. Net inflow of USD 1.7 million
 - D. Net outflow of USD 1.7 million

Q-90. A firm has entered into a USD 20 million total return swap on the NASDAQ 100 index as the index payer with ABC Corporation, which will pay 1-year LIBOR + 2.5%. The contract will last 1 year, and cash flows will be exchanged annually. Suppose the NASDAQ 100 Index is currently at 2,900 and LIBOR is 1.25%. The firm conducts a stress test on this total return swap using the following scenario:

NASDAQ 100 in 1 year: 3,625

LIBOR in 1 year: 0.50%

For this scenario, what is the firm's net cash flow in year 1?

- A. A net cash outflow of USD 4.40 million.
- B. A net cash outflow of USD 4.25 million.
- C. A new cash inflow of USD 4.25 million.
- D. A new cash inflow of USD 4.40 million.

Q-91. The credit protection buyer in a total return swap, where the protection seller pays LIBOR plus a spread, is hedged against each of the following risks except for:

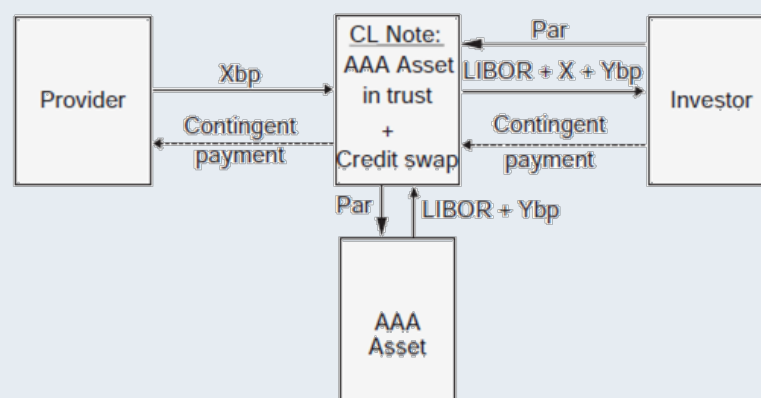
- A. Credit deterioration in the reference.
- B. Spread risk in the reference.
- C. General level of interest rates.
- D. Counterparty exposure to the protection seller.

2.16. Key Point: Credit Derivatives 3 - Credit-Linked Notes

2.16.1. 重要知识点

2.16.1.1. Credit Derivatives 3 - Credit-Linked Notes

- Credit-linked notes are not stand-alone derivatives contracts but instead combine a regular coupon-paying note with some credit risk feature.



2.16.2. 基础题

Q-92. Which of the following statements about credit-linked notes is true?

- A. The borrower receives an enhanced coupon.
- B. The borrower receives a reduced coupon.
- C. The lender receives an enhanced coupon.
- D. The lender receives a reduced coupon.

Q-93. Investors in a credit-linked note (CLN) are most similar to:

- A. Credit default swap (CDS) protection buyers who have funded (prepaid) the contingent credit loss.
- B. Credit default swap (CDS) protection buyers who own (have an insurable interest in) the reference entity.
- C. Credit default swap (CDS) protection sellers who have funded (prepaid) the contingent credit loss.
- D. Credit default swap (CDS) protection sellers who own (have an insurable interest in) the reference entity.

Q-94. Which of the following types of credit derivatives creates the least counterparty credit exposure for the protection buyer?

- A. Total return swap
- B. Equity default swap
- C. Credit-linked note
- D. Senior basket credit default swap

Q-95. XYZ Hedge Fund wants to get exposure to a high-yield pool of commercial loans without actually investing in the loans. It wants a leverage ratio of 7.5. If the hedge fund is willing to invest \$35 million in this investment, which credit derivative is best for them and what is their expected return given that the reference asset earns LIBOR plus 285 basis points, the counterparty earns LIBOR plus 150 basis points, and the required collateral earns 3.5%?

- A. Total return swap with a 13.63% return.
- B. Asset-backed credit-linked note with an 11.34% return.
- C. Total return swap with an 11.34% return.
- D. Asset-backed credit-linked note with a 13.63% return.

Q-96. Bank JJQ, a member of a CCP, sell credit protection on a GBP 100 million CDS. The reference entity is a gold mining company. Which of the following trades on the same reference entity would be a hedge to transfer credit risk with minimal increase in counterparty risk?

- A. Buy a credit-linked notes.
- B. Buy a total return swap.
- C. Sell a credit-linked note.
- D. Sell a total return swap.

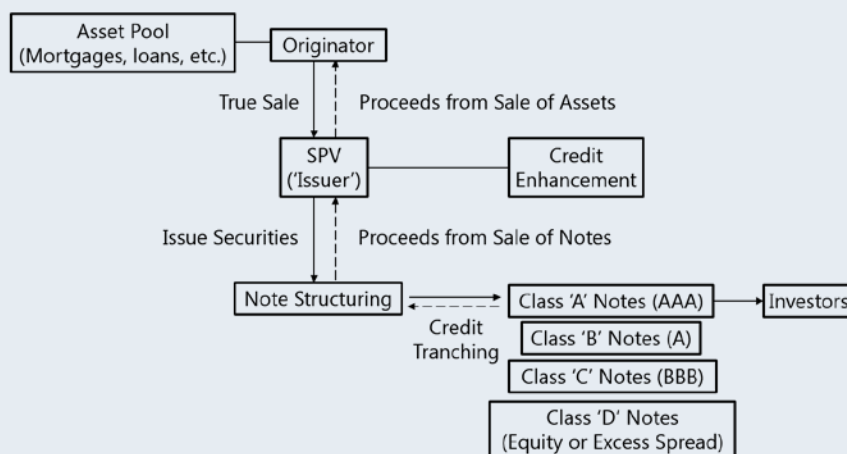
2.17. Key Point: Structured Products & CDO

2.17.1. 重要知识点

2.17.1.1. Structured Products & CDO

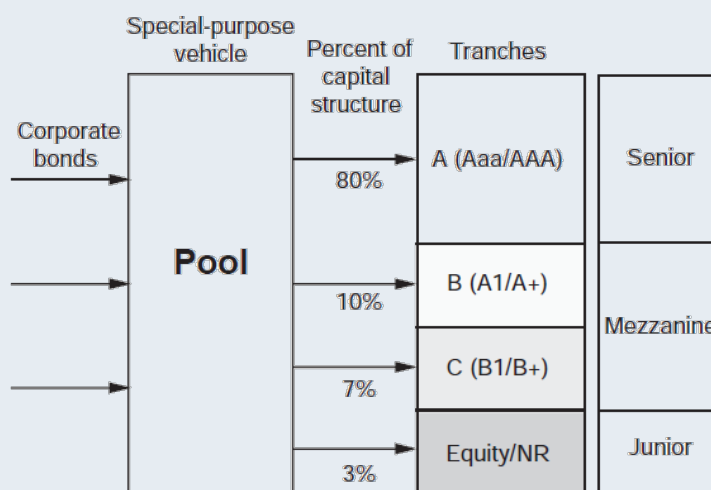
➤ Types of Structured Finance

● Securitization



➤ Structure

● Tranching



● Waterfall

The term “waterfall” is used because the capital structure is paid in a “top down” sequence with the senior debt receiving all of its promised payments before any lower tranche receives any monies.

➤ Structured Products

- Covered Bond
- MBS
- CDO
- Internal credit enhancement
 - Subordination
 - Over collateralization (O/C): more assets are pledged to back the structure and exceed the liabilities
 - Excess spread: a positive excess spread between the collateral assets and the liabilities (coupons) of the SPV, less fees and expenses.
- Effect of PD and Default Correlation
 - The mezzanine effect is mixed.
 - Constant Correlation: Increasing the probability of default will negatively impact the cash flows and, thus, the values of all tranches; Increasing default probability generally decreases the VaR for the equity tranches (less variation in returns) and increases the VaR for the senior tranches (more variation in returns).
 - Constant Probability of Default: The equity tranches increases in value from increasing correlation as the possibility of zero (or few) credit losses increases from the high correlation. Senior VaR increases with correlation. As the default correlation approaches one, the equity VaR increases steadily. The interpretation is that although the mean return is increasing so is the risk as the returns are more variable (large losses or very small losses).
- Performance Analysis

Performance Measure	Calculation	Typical Asset Class
Public Securities Association (PSA)	$PSA = [CPR / (0.2)(\text{months})] * 100$	mortgages, home-equity, student loans
Constant prepayment rate (CPR)	$1 - (1 - SMM)^{12}$	mortgages, home-equity, student loans
Single monthly mortality (SMM)	Prepayment / Outstanding pool balance	mortgages, home-equity, student loans
Weighted average life (WAL)	$\Sigma(a/365) * PF(s)$	mortgages
Weighted average maturity (WAM)	Weighted maturity of the pool	mortgages
Weighted average coupon (WAC)	Weighted coupon of the pool	mortgages
Debt service coverage ratio (DSCR)	Net operating income / Debt payments	commercial Mortgages
Monthly payment rate (MPR)	Collections / Outstanding pool balance	all non-amortizing asset classes
Default ratio	Defaults / Outstanding pool balance	credit cards
Delinquency ratio	Delinquents / Outstanding pool balance	credit cards
Absolute prepayment speed (ABS)	Prepayments / Outstanding pool balance	auto loans, truck loans
Loss curves	Show expected cumulative loss	auto loans, truck loans

2.17.2. 基础题

Q-97. An endowment fund has sold default protection on the most senior tranche of a CDO. If

the default correlation between assets held in the CDO decreases sharply from the correlation used in pricing the CDO tranches, assuming everything else is unchanged, how will the position of the endowment fund be impacted?

- A. It will either increase or decrease, depending on the pricing model used and the market conditions.
- B. It will gain significant value, since the probability of exercising the protection falls.
- C. It will lose significant value, since the protection will gain value.
- D. It will neither gain nor lose value, since only expected default losses matter and correlation does not affect expected default losses.

Q-98. National United Bank has recently increased the bank's liquidity through securitization of existing credit card receivables. The proposed securitization includes tranches with multiple internal credit enhancements as shown in Exhibit 1 below. The total value of the collateral for the structure is USD 600 million, no lockout period, and the subordinated tranche B bond is the first loss piece:

Exhibit 1: Proposed ABS Structure

Bond Class	par value
Senior tranche	USD 250 million
Junior tranche A	USD 200 million
Junior tranche B	USD 70 million
Subordinated tranche A	USD 50 million
Subordinated tranche B	USD 30 million
Total	USD 600 million

At the end of the fourteenth month after the securities were issued, the underlying credit card accounts have prepaid USD 300 million in principal in addition to regularly scheduled principal and interest payments. What is the amount of the prepaid principal paid out to the holders of the junior tranche A bond class?

- A. USD 0 million
- B. USD 50 million
- C. USD 120 million
- D. USD 230 million

Q-99. An investor has sold default protection on the most senior tranche of a CDO. If the default correlation decreases sharply, assuming everything else is unchanged, the investor's position will

- A. Gain significant value since the probability of exercising the protection falls.
- B. Lose significant value since his protection will gain value.

- C. Neither gain nor lose value since only excepted default losses matter and correlation does not affect expected default losses.
- D. It depends on the pricing model used and the market conditions.

Q-100. King Motors Acceptance Corporation (KMAC), the finance arm of King Motors, issues an auto-loan asset-backed security that consists of a senior tranche, denoted Tranche A in the amount of \$50 million and an interest payment of 5 percent, and two subordinated tranches, denoted Tranches X and Z respectively, each with a face amount of \$35 million. Tranche X pays investors annual interest at a rate of 6.5 percent while Tranche Z pays investors annual interest at a rate of 7.5 percent. Which of the following methods of credit support would NOT affect the credit quality of subordinated Tranche X?

- A. The total amount of the auto loans that make up the asset-backed issue is \$125 million.
- B. The weighted average interest rate on the auto loans making up the pool is 6.4 percent.
- C. Any defaults on the part of King Motor's customers will be first absorbed by Tranche Z.
- D. KMAC has a reserve in the amount of \$10 million that will remain on KMAC's balance sheet.

Q-101. A standard synthetic CDO references a portfolio of 10 corporate names. Assume the following. The total reference notional is X, and the term is Y years. The reference notional per individual reference credit name is $X/10$. The default correlations between the individual credit names are all equal to one. The single-name CDS spread for each individual name is 100 bp, for a term of Y years. The assumed recovery rate on default for all individual reference credits is zero in all cases. The synthetic CDO comprises two tranches, a 50% junior tranche priced at a spread J, and a 50% senior tranche priced at spread S. All else constant, if the default correlations between the individual reference credit names are reduced from 1.0 to 0.7, what is the effect on the relationship between the junior tranche spread J and the senior tranche spread S?

- A. The relationship remains the same
- B. S increases relative to J
- C. J increases relative to S
- D. The effect cannot be determined given the data supplied

Q-102. Assume the originator securitizes a \$100 million loan portfolio that pays LIBOR plus 200 bps. Senior expenses of the SPE amount to 20 bps. The SPE issues only two classes of securities: senior debt with face value of \$90 million and subordinated debt with face

value of \$10 million, such that the subordinated debt “functions as equity”. The coupon on the senior debt is LIBOR plus 100 bps. The subordinated debt (equity) gets an interest rate equal to the realized net excess spread. What is the net excess spread?

- A. $\$10 \text{ million} \times (\text{LIBOR} + 3\%)$
- B. $\$10 \text{ million} \times (\text{LIBOR} + 5\%)$
- C. $\$10 \text{ million} \times (\text{LIBOR} + 7\%)$
- D. $\$10 \text{ million} \times (\text{LIBOR} + 9\%)$

Q-103. Which of the following statements regarding frictions in the securitization of subprime mortgages is correct?

- A. The arranger will typically have an information advantage over the originator with regard to the quality of the loans securitized.
- B. The originator will typically have an information advantage over the arranger, which can create an incentive for the originator to collaborate with the borrower in filing false loan applications.
- C. The major credit rating agencies are paid by investors for their rating service of mortgage-backed securities, and this creates a potential conflict of interest.
- D. The use of escrow accounts for insurance and tax payments eliminates the risk of foreclosure.

Q-104. A credit manager who is well versed in lessons learned from the 2007-2009 subprime mortgage crisis in the US is overseeing the structured credit book of a bank in order to identify potential frictions in the securitization process. Which of the following is a correct combination of a potential friction in the securitization process and an appropriate mechanism to mitigate that friction?

- A. Friction between the asset manager and the investor: adverse selection problem. This problem can be mitigated by the asset manager charging due diligence fees to the investor.
- B. Friction between the arranger and the originator: model error problem. This problem can be mitigated by the arranger providing a credit enhancement to the securities with its own funding.
- C. Friction between the investor and credit rating agencies: Principal-agent conflict. This problem can be mitigated by requiring credit rating agencies to be paid by originators and not by investors for their rating services.
- D. Friction between the servicer and the mortgagor: Moral hazard problem. This problem can be mitigated by requiring the mortgagor to escrow funds for insurance and tax payments.

- Q-105.** EACH of the following is an example or element of predatory lending except for:
- A. Lender makes unaffordable loans based on borrower assets rather than ability to repay
 - B. Lender induces borrower to repeatedly refinance ("loan flipping") in order to collect fees and charge high points
 - C. Borrower misrepresents income or employment in mortgage application
 - D. Lender engages in deception to conceal true nature of loan; e.g., deceives borrower into thinking loan is fixed-rate (FRM) when mortgage is actually an adjustable-rate (ARM)
- Q-106.** Each of the following is an example or element of predatory borrowing except for:
- A. Borrower colludes with appraiser to inflate the appraised value of home.
 - B. Borrower makes misrepresentations in regard to income, employment, credit history.
 - C. Use of "nominee loans" that concealing the true identity of the true borrower.
 - D. Borrower is required to pay a prepayment penalty for more than three years, or in an amount larger than six months interest.
- Q-107.** In which of the below the assets remain on the balance sheet of the institution
- A. CMO
 - B. CLO
 - C. MBS
 - D. Covered Bond
- Q-108.** Each of the following is a valid difference between a covered bond and a true securitization except which is not true?
- A. In a covered bond, the cover pool remains on the balance sheet, but in a true securitization, loans (assets) are removed from the balance sheet.
 - B. In a covered bond, principal and interest are paid from issuer's general cash flows, but in a securitization, principal and interest are paid from the collateral pool directly.
 - C. Unlike a true securitization, there is not a "true sale" of assets to a bankruptcy-remote special purpose vehicle in the case of covered bond.
 - D. Unlike a true securitization, a covered bond neither create securities nor is a genuine method for raising funds (i.e., borrowing) in capital markets.
- Q-109.** Which of the following statements about portfolio losses and default correlation are most likely correct?
- I. Increasing default correlation decreases senior tranche values but increases equity

tranche values.

- II. At high default rates, increasing default correlation decreases mezzanine bond prices.
- A. I only
- B. II only
- C. Both I and II
- D. Neither I nor II

Q-110. A collateralized mortgage obligation (CMO) has the characteristics below. Which of the following are most accurate regarding its credit enhancement?

Return on assets	8.75%
Senior tranche	\$400,000,000
Subordinated tranche A	\$120,000,000
Subordinated tranche B	\$50,000,000
Value of collateral	\$600,000,000
Interest paid on liabilities of SPE	7.50%
Fees and expenses	0.60%

- I. There is overcollateralization.
- II. The investors gain credit enhancement through the excess spread.
- A. I only.
- B. II only.
- C. Both I and II.
- D. Neither I nor II.

Q-111. Which of the following is an internal enhancements

- A. Overcollateralization
- B. CDS
- C. Put options on assets
- D. Letters of credit

Q-112. Consider a three-tier securitization structure with the following assumptions:

- The loans in the collateral pool and the liabilities are assumed to have a maturity of 5 years.
- Assets consist of 100 identical loans with par value of \$1 million each, priced at par, paying a fixed 8.5% (i.e., 350 bps over LIBOR flat at 5%).
- Senior debt (senior bonds) of \$85 million paying a coupon of LIBOR + 50 bps.
- Mezzanine debt (junior bonds) of \$10 million paying a coupon of LIBOR + 500 bps
- The scenario assumes a default rate of 10% per annum.

- The money market rate is 5%

Default			Survived	Loan Principal and Interest	Senior Interest	Junior Interest	Excess Spread	Overcollateral	Recovery	OC + Recovery	Equity Flow	OC a/c
t	Annual	Cum'l		0.085	4.875	1						
1	10	10	90	7.8500	4.875	1	1.9750	1.7500	4.0000	5.7500	0.225	5.7500
2	9	19	81	6.8850	4.875	1	1.2100	1.2100	3.8000	4.8100	0	10.8475
3	8	27	73	6.2050	4.875	1	0.5300	0.5300	3.2000	3.7300	0	15.1199
4	7	34	66	5.8100	4.875	1	-0.0850	-0.0850	2.8000	2.7350	0	18.8109
5	7	41	59	64.0150	4.875	1			2.8000			19.5414
Total Terminal Avail Funds												86.3564
Owed to Bond Tranches in Year 5												100.6750

Under this high-default scenario, which of the following statements is true?

- A. There is never a year in which either the junior or senior bonds are paid their full interest
 - B. Both bond holders (senior and junior) realize all of their interest payments in the first four years, but neither recover their entire obligation in the fifth year (i.e., shortfall for both bond holders)
 - C. Junior bond holder suffer interest payment shortfalls and a principal shortfall, but senior bond holders receive all of their interest and experience no principal shortfall
 - D. Both bond holders realize all of their interest payments, in full, and get back the entirety of their principal
- Q-113.** Which of the following statements describe part of the risk mitigation process for a collateralized debt obligation (CDO)?
- I. Default risk is restructured in such a way that previously lower-rated issues can be re-formulated into highly rated debt instruments.
 - II. The equity tranche has no certain return and bears the highest level of default risk.
- A. I only.
 - B. II only.
 - C. Both I and II.
 - D. Neither I nor II.
- Q-114.** Securitized products are often customized to meet the needs of the investor as well as the originator. What type of asset-backed securities (ABSs) typically uses a revolving structure?
- A. Residential mortgage.
 - B. Credit card debt.
 - C. Commercial mortgage.
 - D. Commercial paper.
- Q-115.** A fixed-income portfolio manager purchases a seasoned 5.5% agency mortgage-backed security with a weighted average loan age of 60 months. The current balance on the loans is USD 20 million, and the conditional prepayment rate is assumed to be constant

at 0.4% per year. Which of the following is closest to the expected principal prepayment this month?

- A. USD 1,000
- B. USD 7,000
- C. USD 10,000
- D. USD 70,000

Q-116. Assume an MBS is composed of the following four different pools of mortgages:

- \$2 million of mortgages that have a maturity of 90 days.
- \$3 million of mortgages that have a maturity of 180 days.
- \$5 million of mortgages that have a maturity of 270 days.
- \$10 million of mortgages that have a maturity of 360 days.

What is the weighted average maturity (WAM) of these mortgage pools?

- A. 167 days.
- B. 225 days.
- C. 252 days.
- D. 284 days.

2.18. Key Point: Retail Credit Risk

2.18.1. 重要知识点

4.1.1.1. Credit Decision and Credit Analysis

➤ Key Variables in Mortgage Credit Assessment:

- FICO: Number score of the default risk associated with a borrower's credit history.
- DTI: Debt-to-income ratio is used to qualify mortgage payment and other monthly debt payments versus income.
- LTV: Expresses the amount of a first mortgage lien as a percentage of the total appraised value of the property – i.e., the loan-to-value ratio.
- Scorecard Performance:
- When measuring a scorecard's performance, the validation technique traditionally employed is the cumulative accuracy profile (CAP) and its summary statistic, the accuracy ratio (AR):

$$AR = \frac{A_R}{A_P}$$

2.18.2. 基础题

Q-117. In assessing the key variables associated with a potential mortgage loan, a bank will

charge a higher interest rate if the borrower has a relatively:

- A. High FICO score.
- B. High loan-to-value ratio.
- C. Low debt-to-assets ratio.
- D. Low debt-to-income ratio.

Q-118. A risk manager of ABC bank is looking at the mechanics of a refinancing event. A house was originally purchased for USD 500,000 and financed with an interest-only hybrid adjustable rate mortgage (with a LTV of 80%) at an initial annual fixed rate of 2.75%. Before the interest-only period elapses, the house's appraised value drops to USD 400,000. The homeowner decides to refinance the existing mortgage with a 15-year fixed mortgage at an annual rate of 4.5% (LTV 80%) and uses cash to pay off the remainder of the original mortgage's principal balance. Assuming standard payments, what is the approximate change in monthly payments as a result of the refinancing?

- A. USD 1,500
- B. USD 1,900
- C. USD 2,400
- D. USD 3,000

Q-119. About the cumulative accuracy profile (CAP), each of the following statements is true except which is not?

- A. A perfect credit scoring model generates an accuracy ratio (AR) of 1.0, which is the upper bound on the AR.
- B. A purely random model that cannot differentiate between good and bad customers is likely to generate an accuracy ratio (AR) of 0.40 to 0.60; i.e., 50% +/- 10%.
- C. The CAP curve, which plots the actual rating model as a cumulative percentage of defaults, is monotonically increasing (aka, nondecreasing or weakly increasing).
- D. The CAP curve plots the fraction of defaulted customers (y axis) against the fraction of entire customer population sorted by score from highest risk (left) to lowest risk (right).

Solutions

Q-1. Solution: C

Credit analysis of financial companies has much in common with corporate credit analysis, but the authors cite two key differences: With respect to financial companies, " The differences are: The importance of asset quality; The omission of cash flow as a key indicator."

Q-2. Solution: A

Loan: \$100,000

Interest: \$5,000

Collateral: \$200,000

Profit: \$3,000

It shows that the company's capacity to pay is low.

Q-3. Solution: A

Q-4. Solution: D

Default correlation has no effect on portfolio EL, but is an increasing function with portfolio UL.

Q-5. Solution: B

The expected loss is \$20,000 ($\$1,000,000 \times 0.02$). If there are three defaults, the credit loss is \$60,000 ($3 \times \$20,000$). The credit VaR at the 95% confidence level is \$40,000 (calculated by taking the credit loss of \$60,000 and subtracting the expected loss of \$20,000).

Q-6. Solution: A

The one-month PD = $1 - (100\% - 4\%)^{(1/12)} = 0.3396\%$.

Expected Loss

$$= 98.9846\% \times 0 + 1.10119\% \times \$1.0 \text{ m} + 0.0034\% \times \$2.0 \text{ m} + 0\% \times \$3.0 \text{ m} = \$10,188$$

The probability of zero defaults = $(1 - 0.3396\%)^3 = 98.98464\%$.

Therefore, the 99.0% WCL is one default or \$1.0 million, and

the 99.0% CVaR = \$1.0 million - \$10,188 = \$989,812.

Q-7. Solution: A

The 95% credit VaR corresponds to the unexpected loss at the 95th percentile minus the expected loss, or the expected future value at the 95% loss percentile minus the current value. Using the probabilities in the given ratings transition matrix, the 95% percentile corresponds to a downgrade to BBB, at which the value of the bond would be estimated at 101. Since cash flows

for the bond are not provided, we cannot derive the precise expected and unexpected losses, but the credit VaR (the difference) is easily derived by subtracting the estimated value given a BBB rating from the current value. 95% credit VaR = 110 – 101 = 9.

Q-8. Solution: B

The 95th percentile of the credit loss distribution is \$28,000 ($28 \times \$1,000,000/1,000$). The expected loss is \$20,000 ($\$1,000,000 \times 0.02$). The credit VaR is then \$8,000 ($\$28,000 - \$20,000$).

Q-9. Solution: C

$$\text{Default Correlation} = \frac{0.4\% - 2\% \times 3\%}{\sqrt{2\% \times 98\%} \times \sqrt{3\% \times 97\%}} = 0.142365$$

Q-10. Solution: C

$$UL = 50 \times \sqrt{0.02 \times 0.4^2 + 0.5^2 \times 0.02 \times 0.98} = 4.5$$

Q-11. Solution: B

$$\sqrt{5.5^2 + 5.5^2 + 2 \times 0.28 \times 5.5 \times 5.5} = 8.8$$

$$ULC = \frac{UL_1(UL_1 + \rho UL_2)}{UL_P} = 5.5 \times \frac{5.5 + 0.28 \times 5.5}{8.8} = 4.4$$

Q-12. Solution: B

Statement I is false because the cumulative probability of default increases (i.e., even the highest rated companies will eventually fail over a long enough period). Statement II is true since the probability the firm survives over the next 6 years without default is: $(1-0.08)^6 = 60.6\%$.

Q-13. Solution: A

We first need to realize that the expected number of default in one year, which is $\lambda = 1/5 = 0.2$; Using the Poisson distribution, we solve for the probability that x will be 1.

$$P(X = 1) = \frac{0.2^1 e^{-0.2}}{1!} = 16.37\%$$

Q-14. Solution: D

Q-15. Solution: A

A is correct. The probability that the bond survives for 3 years and then defaults in Year 4 can be

modeled as a Bernoulli trial given by the following equation, where FP stands for forward probability:

$$P(\text{default at end of Year 4}) = (1 - FP_1) \times (1 - FP_2) \times (1 - FP_3) \times FP_4 = 4.9\%$$

Q-16. Solution: B

An objective rating system produces judgments based on considerations tied to credit risk.

Q-17. Solution: C

$$\frac{PD \times RR + (1 - PD) \times 1}{1 + r_f} \times 1,000,000 = 800,000$$

Q-18. Solution: C

$$\frac{1}{(1 + 18\%)^2} = \frac{PD \times 0 + (1 - PD) \times 1}{(1 + 12\%)^2}$$

Q-19. Solution: A

$$86 = \frac{PD \times 0 + (1 - PD) \times 1}{1 + 5\%} \times 100$$

Q-20. Solution: A

First, we compute the current yield on the six-month bond, which is selling at a discount. We solve for y^* such that $99 = 104 / (1 + y^*/2)$ and find $y^* = 10.10\%$. Thus, the yield spread for the first bond is $10.1 - 5.5 = 4.6\%$. The second bond is at par, so the yield is $y^* = 9\%$. The spread for the second bond is $9 - 6 = 3\%$. The default rate for the first period must be greater. The recovery rate is the same for the two periods, so it does not matter for this problem.

Q-21. Solution: D

The probability of default equals the credit risk spread divided by the loss given default. $PD = \text{spread}/LGD$. Here, the spread due to credit risk equals $2.0\% - 0.8\%$ or 1.2% and the loss given default is 60% . The probability of default is then 2% .

Q-22. Solution: C

$$\text{Implied Yield} = \frac{(1 + R_f)}{(1 - PD) + PD \times (1 - LGD)} - 1 = 5.4264\%$$

Q-23. Solution: D

$$1 \times e^{-9\% \times 3} = (1 - PD) \times e^{-3\% \times 3}$$

Q-24. Solution: C

$$PV(\text{risk-free debt}) - \text{put} = 80 \times e^{-0.04 \times 5} - 6.95 = 58.55$$

Q-25. Solution: A

When firms with subordinate debt are experiencing financial distress (low firm values), changes in the value of subordinate debt will react to changes in the model parameters in the same way as equity. Since equity is valued as a call option in the Merton model, a decline in interest rates will reduce the value of equity (and subordinate debt). When firms with subordinate debt are not experiencing financial distress (high firm values), changes in the value of subordinate debt will react to changes in the model parameters in the same way as senior debt. Since senior debt is valued as the difference in firm value less equity valued as a call option in the Merton model, a decline in interest rates will increase the value of senior debt and subordinate debt.

Q-26. Solution: D

A is wrong; the payoff of a bond holder is equivalent to a riskless bond minus a put on the value of a firm. B is wrong, the firm follows lognormal diffusion process, it doesn't allow for sudden change. C is wrong, because in this model default can only occur at the debt maturity.

Q-27. Solution: D

$PD = N(-d_2)$ where d_2 is the distance to default.

$$d_2 = \frac{\ln\left(\frac{20}{15}\right) + 12\% \times 1 - 0.5 \times 35\%^2 \times 1}{35\% \times \sqrt{1}} = 0.99$$

Such that $N(-d_2) = 16.11\%$

Please note we use the asset drift (12%) not the risk free rate, this is not option pricing!

Q-28. Solution: A

$$N[\ln(100/130) - (25\% - (30\%^2)/2) \times 5] / (30\% \times \sqrt{5}) = 2.74\%$$

Q-29. Solution: A

$$\text{The normal returns-based distance to default (DD)} = [\ln(400/300) + (14\% - 36\%^2/2) \times 1] / [36\% \times \sqrt{1}] = 1.0080$$

Q-30. Solution: B

Q-31. Solution: B

Just as an increase in the risk-free rate increases the value of a call option, an increase in the risk-free rate increases the equity value under Merton. However, the risk-free rate has no impact on the Merton PD; the actual return of 8% is used in that application.

Q-32. Solution: A

Distance to Default (DtD) approximates the number of standard deviations to reach the default threshold; thus, the higher the DTD, the least likely to default.

$$DtD = \frac{\ln V - \ln F + \left(\mu - \frac{\sigma^2}{2}\right)(t)}{\sigma\sqrt{t}}$$

DtD can be simplified by reducing the forward time periods to 1 ($t = 1$) and minimizing the drift factors ($\mu - \sigma^2/2$) that tend to be small (assumed to equal 0) over one period to yield:

$$DtD = \frac{\ln V - \ln F}{\sigma}$$

Using this formula results in: Company P = $\ln(100/60)/0.10 = 5.11$

Company Q = $\ln(150/100)/0.07 = 5.79$

Company R = $\ln(250/160)/0.08 = 5.58$

Q is least likely to default; R is in the middle; P is most likely to default.

Q-33. Solution: A

$$-0.015 - \frac{1}{3} \times \ln\left(\frac{95}{100}\right) = 0.21\%$$

Q-34. Solution: B

Moody's KMV model is a model for predicting private company defaults. It covers many geographic specific models, and each model reflects the unique lending, regulatory, and accounting practices of that region. Moody's KMV computes the normalized distance to default as:

$$DD = \frac{A - K}{\sigma_A}$$

where: "K" (floor) is defined as the value of all short term liabilities (one year and under) plus one half of the book value of all long term debt: 40 million + 0.5 × 20 million = 50 million. "A" is the value of assets: Market value of equity (1 million shares × 10/share = 10 million) plus the book value of all debt (60 million) = 70 million. Thus $A\sigma_A = 20\% \times 70 \text{ million} = 14 \text{ million}$.

$DD = (70 \text{ million} - 50 \text{ million}) / 14 \text{ million} = 1.429 \text{ standard deviations}$

Q-35. Solution: C

Default Point:

$$\left(500 + \frac{1}{2} \times 300\right) = 650$$

Distant to Default:

$$\frac{1200 - \left(500 + \frac{1}{2} \times 300\right)}{1200 \times 10\%} = 4.58$$

Q-36. Solution: D

While KMV computes the forward DD as a standard deviation, it does not assume normal returns/lognormal asset value. This is explicitly considered insufficient to model empirically heavy tails. Rather KMV first measures the distance-to-default as the number of standard deviations the asset value is away from default and then uses empirical data to determine the corresponding default probability.

Q-37. Solution: A

Q-38. Solution: C

Lambda = 6 defaults/12 month = 0.5 defaults per month.

$$P = 1 - \exp(-0.5) = 39.35\%$$

Q-39. Solution: D

The conditional one-year PD is equal to 8.6%, same as the unconditional one-year default probability.

Q-40. Solution: A

Using λ to represent the given hazard rate, we can calculate the cumulative probability of default in the first year using the formula $1 - \exp(-\lambda)$, which equals 0.09516.

Then, the cumulative probability that the firm defaults in the second year is equal to $1 - \exp(-2 \times \lambda)$ or 0.18127; Then, the probability of survival in the first year followed by a default in the second year is closest to: $0.18127 - 0.09516 = 0.08611$.

Q-41. Solution: B

Conditional default has a mean of $0.40 \times (-1) = -0.40$ and a volatility of $\sqrt{1 - 0.4^2} = 0.92$. The loss threshold is -2.33. Therefore the conditional default probability is:

$$\Phi\left(\frac{-2.33 - (-0.4)}{0.92}\right) = 1.8\%$$

Q-42. Solution: D

Q-43. Solution: B

Potential Future Exposure measures the distribution of exposures of high percentile.

Q-44. Solution: B

Q-45. Solution: B

The EE will be less than the 95% PFE.

Q-46. Solution: D

Maximum PFE is a single value. Maximum PFE simply represents the highest (peak) PFE value over a given time interval

Q-47. Solution: A

Selling a put option exposes you to zero counterparty credit risk as the premium is paid up front. The correct answer is therefore A. All the information necessary to price the option is provided but it is not necessary. The value of the put option is USD 24.90 (answer D) while the value of a call option with one year to expiration is 0.38.

Q-48. Solution: A

Measures such as EE and EPE may underestimate exposure for short-dated transactions (since capital measurement horizons are typically 1-year) and not capture properly rollover risk (Chapter 3). For these reasons, the terms effective EE and effective EPE were introduced by the Basel Committee on Banking Supervision (2005). Effective EE is simply a non-decreasing EE. Effective EPE is the average of the effective EE.

Q-49. Solution: C

Q-50. Solution: D

The CD has the whole notional at risk. Otherwise, the next greatest exposure is for the forward currency contract and the interest rate swap. The short cap position has no exposure if the premium has been collected. Note that the question eliminates settlement risk for the forward

contract.

Q-51. Solution: B

With an upward-sloping term structure, the fixed payer has greater credit exposure. He receives less initially, but receives more later. This back-loading of payments increases credit exposure. Conversely, if the forward curve flattens, the fixed payer (i.e., BNP Paribas) has less credit exposure. Credit Agricole must have greater credit exposure. Alternatively, if LIBOR drifts down, BNP will have to pay more, and its counterparty will have greater credit exposure.

Q-52. Solution: C

PFE of cross-currency swap, which combines the exposure of an interest rate swap and the FX forward. The dotted must be the average PFE (aka, AWCE) since it is a flat line.

Q-53. Solution: B

The risk of cross-currency swaps is driven by a large final payoff, and thus the profile increases monotonically until the maturity of the trade. The FX risk of the notional exchange dominates the small contribution due to interest rate exposure.

Q-54. Solution: A

A is correct. Given the risk-free rate of 3.0%, we can estimate the forward price (at maturity, in nine months) of the contract as:

$$\text{Forward price} = \text{spot} \times e^{r \times t} = 92 \times e^{0.03 \times 0.75} = \text{EUR } 94.093 \text{ million}$$

Today, after 6 months (3 months to maturity)

$$\text{Forward contract price estimate} = 94.093 \times e^{-0.03 \times 0.25} = \text{EUR } 93.39 \text{ million}$$

Note that, Forward Contract Value = Credit Risk Exposure;

Therefore, given that the current (with 3 months remaining to maturity) underlying asset price of EUR 94 million, the long forward contract's value is given by:

$$\text{Current value} = 94 - 93.39 = \text{EUR } 0.61 \text{ million}$$

which represents exposure, and is the value to the long (TMI) because the contract is a claim on the asset, which is currently worth EUR 94.0 million, and an obligation to pay EUR 94.093 million for it in 3 months. Because the contract value of EUR 0.610 million is positive, the long counterparty (TMI) bears the credit risk exposure.

$$\text{Positive exposure} = \text{Max}(\text{value}, 0)$$

$$\text{Negative exposure} = \text{Min}(\text{value}, 0)$$

For forwards, while there is no current exposure (because payment is only made at expiration, there is always positive potential exposure as long as market price > contract price, and negative potential exposure if market price < contract price. At origination (time 0), there is neither

current nor potential exposure (since market price = contract price).

B is incorrect (see explanation above).

C and D are incorrect. They compute the contract price incorrectly by discounting the forward value over 6 months and not 3 months.

Q-55. Solution: B

Understanding which trades have the greatest impact on a counterparty's credit value adjustment requires use of the marginal CVA. Incremental CVA, by contrast, is useful for pricing a new trade with respect to an existing one.

Q-56. Solution: C

From the perspective of the financial institution:

$$\begin{aligned} & \text{EPE} \times \text{counterparty credit spread} - \text{ENE} \times \text{institution credit spread} \\ &= 5\% \times 300 - 3\% \times 200 = 9 \text{ bps} \end{aligned}$$

This is what the financial institution may charge the counterparty for overall counterparty risk.

Q-57. Solution: A

Q-58. Solution: C

$$\text{The BSM call option price} = 100 \times 0.64 - 100 \times e^{-3\%} \times 0.4 = \$25.182$$

which does not include counterparty risk incurred by the long option position (the short has no counterparty risk). The CVA-adjusted value = $\$25.182 - \$23.00 \times 5\% \times 75\% = \24.32

Q-59. Solution: C

We refer to wrong-way risk as the adverse (negative) correlation between the exposure to the counterparty and its credit quality. Alternatively, it can be stated as the positive correlation between exposure and credit spread.

Q-60. Solution: C

Q-61. Solution: B

The BCVA formula differs from the CVA formula in that BCVA incorporates negative expected exposure (NEE), and the probability of the counterparty's survival must be included in the BCVA formula.

Q-62. Solution: C

The lower credit qualities and increased credit spreads should result in higher DVA and CVA for

both ADB and HIP. Therefore, only C is correct and A, B and D are all incorrect.

Q-63. Solution: A

A is correct. To derive the credit valuation adjustment (CVA), we use the standard formula:

$$CVA = \sum_{i=0}^n LGD_i \times EE_i \times PD_i \times DF_i$$

Where (at any time t),

The discount factor (DF_t) is determined from the risk-free rate of 2%; and

$$\text{Hazard rate} = \frac{\text{Spread}}{1-RR} = 12\% \text{ (True for years 2 and 3)}$$

The probability of default $PD(t)$, marginal probability, is derived from the relationship between cumulative probability of default $PD(c,t)$ and the constant hazard rate (λ):

$$PD(c,t) = 1 - e^{-\lambda t}$$

$$PD(c,1) = 1 - e^{-0.12 \times 1} = 11.31\%, \text{ and so } PD_1 = 11.31\%$$

$$PD(c,2) = 1 - e^{-0.12 \times 2} = 21.34\%, \text{ and so } PD_2 = 21.34\% - 11.31\% = 10.03\%$$

$$PD(c,3) = 1 - e^{-0.12 \times 3} = 30.23\%, \text{ and so } PD_3 = 30.23\% - 21.34\% = 8.89\%$$

	Year 0	Year 1	Year 2	Year 3
Hazard Rate (λ)		12%	12%	12%
Probability of default (cumulative) ($PD(c,t)$)		11.31%	21.34%	30.23%
Probability of default (marginal) ($PD(t)$)		11.31%	10.03%	8.89%
Discount factor (DF)		0.9804	0.9612	0.9423
Recovery rate		0.85	0.75	0.65
Expected exposure (EE) (AUD million)		15	15	15
Collateral (C) (AUD million)		13	13	13
EE' (netted) (AUD million)		2	2	2
$LGD \times EE' \times PD(t) \times DF$		0.0333	0.0482	0.0586
CVA (AUD million)	0.1401			

B is incorrect. AUD 0.172 million is the result obtained when the hazard rate is used instead of the PD. C is incorrect. AUD 0.442 million is the result obtained when the recovery rate and not the LGD is used. D is incorrect. AUD 1.051 million is the result obtained when collateral is not considered.

Q-64. Solution: D

D is correct. Given the risk-free rate of 4.0%, we can estimate the forward price (at maturity, in nine months) of the contract as: Forward price = Spot*exp($r \times t$) = 20.3*exp(0.04*0.75) = EUR 20.9182 million.

Today, after 3 months (6 months remaining to maturity), the forward contract price estimate = $20.9182/\exp(0.04*0.5)$ = EUR 20.5040 million.

Note that, Forward Contract Value = Credit Risk Exposure.

Therefore, given that the current (with 6 months remaining to maturity) underlying asset price of EUR 23.5 million, the long forward contract's exposure value is given by:

Current Potential Exposure Value of Forward Contract = (Market Price – Contract Price)
= $23.5 - 20.5040$ = EUR 2.996 million.

Because the contract value of EUR 2.996 million is positive, the long counterparty (VCC) bears the credit risk exposure.

Positive exposure = $\text{Max}(\text{value}, 0)$, Negative exposure = $\text{Min}(\text{value}, 0)$ and for long forward contracts: Contract Value = (Market Price – Contract Price).

For forwards, while there is no current credit risk (loss), because payment is only made at expiration, there is always positive potential exposure so long as market price > contract price, and negative potential exposure if market price < contract price. At origination (time 0), there is neither current credit risk nor potential credit exposure (since market price = contract price).

A and B are incorrect. They compute the contract price incorrectly by discounting the forward value over 3 months and not 6 months as follows:

The forward contract price = $20.9182 * \exp(-0.04*0.25)$ = EUR 20.7101 million. Therefore,
Current Value of Forward Contract = (Market Price – Contract Price) = $23.5 - 20.7101$ = EUR 2.7899 million. C is incorrect (see explanation for D above).

Q-65. Solution: C

Q-66. Solution: D

The hedge fund has wrong-way risk. As interest rates rise, both Bank HJK's and Bank PQR's equity value would decline since the performances of the two banks are highly correlated. Therefore, the value of the long put option on PQR would increase, resulting in a higher exposure to bank HJK for the hedge fund. This is a wrong-way risk since the hedge fund's exposure to HJK would be increasing as the credit quality of HJK is declining.

The manufacturer also has wrong-way risk. Since the credit spread of Bank HJK is increasing and credit spreads of different banks in the same market tend to be positively correlated, the credit spread of Bank PQR should also increase. Therefore, the value of the manufacturer's long CDS position on Bank PQR is increasing at the same time the credit quality of Bank HJK is decreasing; thus, that is wrong-way risk.

Q-67. Solution: D

D is correct. "Buying a put option on a stock (or stock index) where the underlying in question has

fortunes that are highly correlated to those of the counterparty is an obvious case of wrong-way risk". Thus, choices A and C are ruled out.

Also, "an out-of-the-money put option will have more wrong-way risk than an in-the-money one." That implies option D is the only correct one.

Q-68. Solution: B

Netting means that the payments between the two counterparties are netted out, so that only a net payment has to be made. With netting, the investment firm is not required to make every payout, hence the loss will be reduced to: USD 32 million + USD 12 million – USD 16 million – USD 8 million = USD 20 million. Without netting, the loss is the outstanding long position: USD 32 million + USD 12 million = USD 44 million.

Q-69. Solution: A

The properly netted amounts are: For A: B = \$0, C = \$5, D = \$0, for a sum of \$5. For B: A = \$0, C = \$0, D = \$8, for a sum of \$8. For C: A = \$0, B = \$5, D = \$1, for a sum of \$6. For D: A = \$9, B = \$0, C = \$0, for a sum of \$9.

Q-70. Solution: D

The greatest netting benefit among the scenarios presented occurs when the two trades have a strong negative correlation. In this case, a large portion of the negative exposures will offset positive exposures.

Q-71. Solution: D

	MtM		Total Exposure		Netting Factor
	Trade 1	Trade 2	No netting	Netting	
Scenario 1	25	15	40	40	
Scenario 2	15	-10	15	5	
Scenario 3	10	-5	10	5	
Scenario 4	5	-5	5	0	
Scenario 5	-5	-10	0	0	
EE			14	10	71.43%

Q-72. Solution: C

$$\text{Netting factor} = \frac{\sqrt{n + n \times (n - 1) \times \rho}}{n}$$

Where n represents the number of exposures and ρ represents the average correlation.
For the current position, when $n = 8$ and $\rho = 0.28$,

$$\text{netting factor} = \frac{\sqrt{8 + 8 \times 7 \times 0.28}}{8} = 60.83\%$$

For A, when $n = 4$, $\rho = 0.25$, there is only a modest netting benefit.

$$\text{netting factor} = \frac{\sqrt{4 + 4 \times 3 \times 0.25}}{4} = 66.14\%$$

For B, when $n = 7$, $\rho = 0.15$, there is reduction in netting factor but not as much as in C.

$$\text{netting factor} = \frac{\sqrt{7 + 7 \times 6 \times 0.15}}{7} = 52.10\%$$

For C, when $n = 13$, $\rho = -0.06$, there is the most reduction in netting factor.

$$\text{netting factor} = \frac{\sqrt{13 + 13 \times 12 \times (-0.06)}}{13} = 14.68\%$$

For D, when $n = 15$, $\rho = -0.04$, there is a reasonable reduction in netting factor but not as much as in C.

$$\text{netting factor} = \frac{\sqrt{15 + 15 \times 14 \times (-0.04)}}{15} = 17.13\%$$

Q-73. Solution: C

Define X and Y as the absolute values of the positive and negative positions. The net value is $X - Y = 20$ million. The absolute gross value is $X + Y = 80$. Solving, we get $X = 50$ million. This is the positive part of the positions, or exposure.

Q-74. Solution: B

Q-75. Solution: D

"a" is a walk-away clause.

"b" is a close-out netting.

"c" is Termination.

Q-76. Solution: D

Increasing collateral would effectively reduce current credit exposure depending on the contract parameters, mainly minimum transfer amount and threshold.

Q-77. Solution: A

A is correct. Threshold is the amount of uncollateralized exposure. A lower threshold value means a larger portion of exposure is protected by collateral.

Similarly, C is incorrect because a lower independent amount is equivalent to a higher threshold.

That corresponds to a smaller portion of exposure being protected.

B is incorrect because the margin period of risk is the effective time assumed between a

collateral call and receiving the appropriate collateral. It has nothing to do with the amount of collateral.

D is incorrect. Collateral has little effect at both the beginning and the end of the exposure profile when the exposure is relatively small.

Q-78. Solution: B

The overall annual volatility of the position (exposure + collateral) is $(0.06^2 + 0.08^2) = 0.10$ or 10%. Therefore, actual calculations of the changes in value of the position for a specified time horizon and confidence level are not necessary, since 10% is greater than that of the exposure (6%) and the collateral (8%). The correct choice is B) – the collateral mitigates the exposure today while increasing the volatility of the position in the future.

Q-79. Solution: A

Counterparty exposure, in theory, can be almost completely neutralized as long as a sufficient amount of high quality collateral, such as cash or short-term investment grade government bonds, is held against it. If the counterparty were to default, the holder of an open derivative contract with exposure to that counterparty would be allowed to receive the collateral. Cross-product netting would only reduce the exposure to one of the counterparties, and purchasing credit derivatives would replace the counterparty risk from the individual counterparties with counterparty risk from the institution who wrote the CDS.

Q-80. Solution: B

Lack of standardized products, complexity, illiquid products, and presence of wrong-way risk are characteristics of OTC derivative products that make CCP clearing challenging. OTC derivative products need to be standardized before they can be cleared through a CCP. More complex and illiquid derivative products are problematic for CCPs because their unique features make them difficult to value. Products with wrong-way risk are also more complex and create additional concerns for the added risk to CCPs in the event of default.

Q-81. Solution: C

The calculation of the initial margin should be based on volatility, tail risk, and dependency. The value at risk (VaR) approach is a more advanced method than the SPAN approach for calculating initial margins. Studies suggest that the VaR approach does a good job of setting initial margins at the 95% confidence level, but at the 99% confidence level initial margins are not sufficient. The initial margin depends primarily on market risk and not the credit quality of the clearing member.

Q-82. Solution: D

If it uses a clearinghouse and the clearinghouse makes a mistake (operational risk) like that made by ABC, ABC will have recourse to the clearinghouse and it would have, therefore, reduced its operational risk exposure.

A. Incorrect. ABC is not funding from Repo Co.

B. Incorrect. The use of a clearinghouse does not change Repo Co.'s default risk – just ABC's exposure to Repo Co. defaults.

C. Incorrect. The use of a clearinghouse in this situation does not reduce XYZ's lending risk.

Q-83. Solution: C

Payment netting is the simple netting of cash flows due on the same day.

Closeout netting occurs if there is an event of default, which would include an incidence of fraud.

One of the shortcomings of clearinghouses, and closeout netting as well, is that the other party, in this case ABC, jumps to the head of the queue with its claim on Repo Co. to the possible detriment of others, particularly those outside the clearinghouse in general.

Thus, only C is correct.

Q-84. Solution: D

Choices A and B can be eliminated because payments in default are made from protection seller to protection buyer. The payoff from the digital swap will be 50% of par value while the payoff from the single name will be 40% (i.e., $1 - 0.6$) of par value.

Q-85. Solution: D

The protection buyer is exposed to the joint risk of default by the counterparty and underlying credit. If only one defaults, there is no credit risk.

Q-86. Solution: A

A digital CDS will pay off a pre-determined fixed amount in the event of a default. Digital CDS are often used against highly illiquid reference assets that would be difficult to price.

Q-87. Solution: A

Because LIBOR is flat, the fixed-coupon yield is also 4.6%, creating a spread of $800 - 460 = 340\text{bp}$ on the bond. Going long the bond and short credit via buying the CDS yields an annual profit of $340 - 150 = 190\text{bp}$.

Q-88. Solution: A

A break clause – a.k.a., “liquidity put” or early termination option (ETO) – is an agreement to terminate (break) a transaction at pre-specified dates in the future.

Q-89. Solution: A

Q-90. Solution: B

The NASDAQ will increase 25%, or $(3625/2900) - 1$, over the next year, so the index payer will pay USD 5 million (0.25×20 million) to ABC Corp. Since ABC Corp's payments depend on today's LIBOR, it will pay 3.75% ($1.25\% + 2.5\%$) or USD 0.75 (0.0375×20 million). So the firm's net cash flow would be 0.75 million – 5 million = -USD 4.25 million.

Q-91. Solution: D

The TRS provides a hedge against credit and market risk. In the case of LIBOR, a higher interest rate implies a loss on the reference, however this is hedged by the protection sellers higher payments.

Q-92. Solution: C

In a credit-Linked note, the lender (note holder) receives an enhanced coupon as compensation for bearing the credit risk of the issuer.

Q-93. Solution: C

A CLN is like a funded CDS; the investors are selling protection (synthetically short the reference) In regard to (d), neither counterparty needs to own the reference.

Q-94. Solution: C

Q-95. Solution: D

The best credit derivative for this hedge fund is an asset-backed credit-linked note. With leverage of 7.5 and an investment of \$35 million, we know that the notional value of the pool of commercial loans is \$262.5 million. The hedge fund will earn 3.5% on their \$35 million in collateral. This translates into \$1.225 million. They will also earn the 135 basis point spread on the entire \$262.5 million. This translates into \$3.54375 million. The hedge fund's percentage return is 13.63% $[(\$1.225 \text{ million} + \$3.54375 \text{ million})/\$35 \text{ million}]$.

Q-96. Solution: C

C is correct. Selling/issuing a credit-linked note (CLN) transfers credit risk to the investors while there is no counterparty risk for the CLN issue because CLNs are funded. Since CLN is essentially a funded version of CDS, it can be used to hedge the short position of CDS with minimal increase in counterparty risk. To explain further, a CLN trade means the buyer pays the seller the principal of the note and receives a regular coupon throughout the lifetime of that CLN. If there is no credit

event happening to the reference entity, the principal will be paid back to the investor. Otherwise, the CLN buyer will receive the collateral (i.e., the defaulted referenced bond) and the coupon payment will stop. Thus, the CLN buyer is the protection seller and the issuer is the protection buyer. If the CDS and CLN are fairly priced, the seller of CDS can hedge his position by issuing CLN. Also, since the principal is kept by Bank in the beginning of the CLN trade, the increment in counterparty risk created by such hedge should be minimal.

A is incorrect. The CLN buyer, like a bond buyer, bears counterparty risk as the issuer can default on principal and interests.

B and D are incorrect. The total return swap (TRS) has counterparty risk. In general, TRS is not funded.

Q-97. Solution: B

The senior tranche will gain value if the default correlation decreases. High correlation implies that if one name defaults, a large number of other names in the CDO will also default. Low correlation implies that if one name defaults, there would be little impact on the default probability of the other names. Therefore, as the correlation decreases, the cumulative probability of enough defaults occurring to exceed the credit enhancement on the senior tranche will also decrease. Hence the investor who has sold protection on the senior tranche will see a gain.

Q-98. Solution: B

USD 50 million is calculated by $\text{USD}300 - \text{USD}250 = \text{USD}50$, since prepayments are first distributed to the senior tranches.

Q-99. Solution: A

Q-100. Solution: D

An investor's claim when purchasing an ABS is solely with the ABS and no longer with the originator. The fact that KMAC has \$10 million set aside means nothing for the ABS issue if it remains on KMAC's balance sheet and is not part of the ABS issue. The other answer choices all describe forms of credit support that will support at least Tranches X and A, if not all 3 tranches. By having Tranche Z be subordinate to Tranche X, Tranche X has additional support. Also, loans of \$125 million are used to back asset-backed securities worth $(\$50 + \$35 + \$35) = \120 million, which means the issue, is over-collateralized. The weighted average interest rate paid on the securities is approximately 6.2%. If the weighted average interest rate on the loans that make up the pool is 6.4% that means there is an excess spread between the loans and securities that also provides support for the entire issue.

Q-101. Solution: C

If the correlation is one, all names will default at the same time, and the junior and senior tranche will be equally affected. Hence, their spread should be 100bp, which is the same as for the collateral. With lower correlations, the losses will be absorbed first by the junior tranche. Therefore, the spread on the junior tranche should be higher, which is offset by a lower spread for the senior tranches.

Q-102. Solution: D

Excess spread = 100 million \times (LIBOR + 200 bps – 20bps) – 90 million \times (LIBOR + 100bps)
= 10 million \times (LIBOR + 9%)

Q-103. Solution: B

One of the key frictions in the process of securitization involves an information problem between the originator and arranger. In particular, the originator has an information advantage over the arranger with regard to the quality of the borrower. Without adequate safeguards in place, an originator can have the incentive to collaborate with a borrower in order to make significant misrepresentations on the loan application. Depending on the situation, this could be either construed as predatory lending (where the lender convinces the borrower to borrow too large of a sum given the borrower's financial situation) or predatory borrowing (the borrower convinces the lender to lend too large a sum).

The major rating agencies are not paid by the investors. Escrow accounts can forestall but not eliminate the risk of foreclosure.

Q-104. Solution: D

D is correct. The friction between the servicer and the mortgagor is a moral hazard problem. The servicer and the mortgagor do not share the full consequence of bad outcomes (e.g., loan foreclosure, delinquencies.) The mortgagor typically has limited liability, and has little incentive to expend effort or resources to maintain a property close to foreclosure. On the other hand, the servicer strives to work in investors' best interest by keeping up with payment of property taxes and insurance, and generally maintaining the property. A way to mitigate this friction is to require the mortgagor to regularly escrow funds for insurance and tax payments in order to forestall the risk of foreclosure.

A is incorrect. Friction between the asset manager and the investor is a principal-agent problem. The investor is less sophisticated than the asset manager, does not fully understand the investment strategy of the asset manager, has uncertainty about the manager's ability, and does not observe any effort that the manager makes to conduct due diligence. Some of the ways to

mitigate this friction is through the use of investment mandate, and the evaluation of manager performance relative to its peers or a peer benchmark.

B is incorrect. Friction between the arranger and originator is a predatory borrowing and lending problem. It is one of the key frictions in the process of securitization involving an information problem between the originator and arranger. In particular, the originator has an information advantage over the arranger with regard to the quality of the borrower. Without adequate safeguards in place, an originator can have the incentive to collaborate with a borrower in order to make significant misrepresentations on the loan application. Depending on the situation, this could be either construed as predatory lending (where the lender convinces the borrower to borrow too large of a sum given the borrower's financial situation) or predatory borrowing (the borrower convinces the lender to lend too large a sum). To mitigate the problem, the arranger should have safeguards in place, including carrying out a thorough due diligence on the originator and requiring the originator to have adequate capital to buy back problem loans.

C is incorrect. Friction between the investor and credit rating agencies is a model error problem. Investors are not able to assess the efficacy of rating agency models and; so, are susceptible to both honest and dishonest errors. Worse still, rating agencies are paid by the arranger and not by the investors for their opinion, which creates a potential conflict of interest. This friction can be mitigated by requiring public disclosure of the criteria for ratings and downgrades, and for holding rating agencies accountable for their reputation.

Q-105. Solution: C

Q-106. Solution: D

In regard to (D), this is an example or sign of predatory lending. Ashcraft: "Predatory borrowing is defined as the willful misrepresentation of material facts about a real estate transaction by a borrower to the ultimate purchaser of the loan. This financial fraud might also involve cooperation of other insiders – realtors, mortgage brokers, appraisers, notaries, attorneys. The victims of this fraud include the ultimate purchaser of the loan (for example a public pension), but also include honest borrowers who have to pay higher interest rates for mortgage loans and prices for residential real estate."

Q-107. Solution: D

Q-108. Solution: D

Covered bond and securitization are similar in the sense that both methods do issue securities, which are backed by assets, as a means to raise funds (borrow) in capital markets.

Q-109. Solution: A

Q-110. Solution: C

The total value of the tranches is: $\$400 + \$120 + \$50 = \570 million. The value of the collateral is $\$600$ million, so the CMO is over collateralized by $\$30$ million.

The net excess spread is $8.75\% - 7.50\% - 0.60\% = 0.65\%$, so there is positive excess spread. This provides credit enhancement for the CMO investors.

Q-111. Solution: A

Internal enhancements include: overcollateralization, direct equity issue, holdback, cash collateral account (CCA), excess spread.

External credit enhancement include, insurance, warps, and guaranties, letters of credit, CDS, put options on assets.

Q-112. Solution: B

Q-113. Solution: C

The default risk in a CDO is structured through various tranches in such a way that a pool of assets that were once lower rated could be AAA rated after the securitization process. The equity tranche is the most junior tranche. Therefore, it offers the highest return potential but with no certain return. The equity tranche also bears the highest level of default risk.

Q-114. Solution: B

Revolving structures are used with products that are paid back on a revolving basis, such as credit card debt or auto loans. Credit card debt does not have a pre-specified amortization schedule; therefore the principal paid back to investors is in large lump sums rather than amortizing schedules.

Q-115. Solution: B

$CPR = 0.4\%$, therefore, $SMM = 1 - (1 - CPR)^{(1/12)} = 0.03\%$

$I/Y = 5.5/12$, $N = 60$, $PV = 20,000,000$, $FV = 0 \rightarrow PMT = 382,023.24$

Interest payment = $20,000,000 \times 5.5\%/12 = 91,666.67$

Principal payment = $382,023.24 - 91,666.67 = 290,356.58$

$SMM = \text{prepayment}/(\text{beginning balance} - \text{scheduled principal payment}) = 0.03\% = \text{prepayment}/(20,000,000 - 290,356.58)$

Therefore, prepayment = 6,581.96

Q-116. Solution: D

The WAM is calculated as follows: $WAC = [90(2 \text{ million}) + 180(3 \text{ million}) + 270(5 \text{ million}) + 360(10 \text{ million})] / (2 \text{ million} + 3 \text{ million} + 5 \text{ million} + 10 \text{ million}) = 284 \text{ days}$

Q-117. Solution: B

The loan-to-value ratio represents the amount of the mortgage versus the appraised value of the property. The higher this ratio is for a property and an associated borrower, the more risk there is to the lender. In order to protect their position, a lender will charge a higher interest rate. Each of the other scenarios will result in a lower interest rate.

Q-118. Solution: A

LTV = 80%

$\text{Loan1} = 80\% \times 500,000 = 400,000$

$\text{Monthly payment1} = 400,000 \times 2.75\% / 12 = 917$

$\text{Loan2} = 80\% \times 400,000 = 320,000$

$I/Y = 4.5/12, N = 15 \times 12, PV = 320,000, FV = 0 \rightarrow PMT = 2,448$

$\text{Change in monthly payment} = 2,448 - 917 = 1,531$

Q-119. Solution: B