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PRM Certification - Exam III: Risk Management Frameworks, Operational Risk, Credit Risk, Counterparty Risk, Market Risk, ALM, FTP - 2015 Edition

PRMIA 8008

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QUESTION NO: 1

Which of the following is a cause of model risk in risk management?

A. Programming errors

B. Misspecification of the model

C. Incorrect parameter estimation

D. All of the above

ANSWER: D

Explanation:

: Model risk is the risk that a model built for estimating a variable will produce erroneous estimates. Model risk is caused by a number of factors, including:

a) Misspecifying the model: For example, using a normal distribution when it is not justified.

b) Model misuse: For example, using a model built to estimate bond prices to estimateequity prices

c) Parameter estimation errors: In particular, parameters that are subjectively determinedcan be subject to significant parameter estimation errors

d) Programming errors: Errors in coding the model as part of computer implementation maynot be detected by end users

e) Data errors: Errors in data used for building the model may also introduce model risk Therefore the correct answer is d, as all the choices are a source of model risk.

QUESTION NO: 2

Which of the following are true:

I. The total of the component VaRs for all components of a portfolio equals the portfolio

VaR.

II. The total of the incremental VaRs for each position in a portfolio equals the portfolio

VaR.

III. Marginal VaR and incremental VaR are identical for a $1 change in the portfolio.

IV. The VaR for individual components of a portfolio is sub-additive, ie the portfolio VaR isless than (or in extreme cases equal to) the sum of the individual VaRs.

V. The component VaR for individual components of a portfolio is sub-additive, ie theportfolio VaR is less than the sum of the individual component VaRs.

A. II and V

B. II and IV

C. I and II

D. I, III and IV

E. The total of the component VaRs for all components of a portfolio equals the portfolio VaR.

II. The total of the incremental VaRs for each position in a portfolio equals the portfolio VaR.

III. Marginal VaR and incremental VaR are identical for a $1 change in the portfolio.

IV. The VaR for individual components of a portfolio is sub-additive, ie the portfolio VaR isless than (or in extreme cases equal to) the sum of the individual VaRs.

F. The component VaR for individual components of a portfolio is sub-additive, ie theportfolio VaR is less than the sum of the individual component VaRs.

ANSWER: D

Explanation:

:

Statement I is true - component VaR for individual assets in the portfolio add up to the total VaR for the portfolio. This property makes component VaR extremely useful for risk disaggregation and allocation.

Stateent II is incorrect, the incremental VaRs for the positions in a portfolio do not add up to the portfolio VaR, in fact their sum would be greater.

Statement III is correct. Marginal VaR for an asset or position in the portfolio is by definition the change in the VaR as a result of a $1 change in that position. Incremental VaR is the change in the VaR for a portfolio from a new position added to the portfolio - and if that position is $1, it would be identical to the marginal VaR.

Statement IV is correct, VaR is sub-additive due to the diversification effect. Adding up the

VaRs for all the positions in a portfolio will add up to more than the VaR for the portfolio as a whole (unless all the positions are 100% correlated, which effectively would mean they are all identical securities which means the portfolio has only one asset).

Statement V is in incorrect. As explained for Statement I above, component VaR adds up to the VaR for the portfolio.

QUESTION NO: 3

Financial institutions need to take volatility clustering into account:

I. To avoid taking on an undesirable level of risk

II. To know the right level of capital they need to hold

III. To meet regulatory requirements

IV. To account for mean reversion in returns

A. II, III and IV

B. I & II

C. I, II and III

D. I, II and IV

E. To avoid taking on an undesirable level of risk

II. To know the right level of capital they need to hold

III. To meet regulatory requirements

IV. To account for mean reversion in returns

ANSWER: B

Explanation:

:

Volatility clustering leads to levels of current volatility that can be significantly different from long run averages. When volatility is running high, institutions need to shed risk, and when it is running low, they can afford to increase returns by taking on more risk for a given amount of capital. An institution's response to changes in volatility can be either to adjust risk, or capital, or both. Accounting for volatility clustering helps institutions manage their risk and capital and therefore statements I and II are correct.

Regulatory requirements do not require volatility clustering to be taken into account (at least not yet). Therefore statement III is not correct, and neither is IV which is completely unrelated to volatility clustering.

QUESTION NO: 4

Which of the following statements is true in relation to collateral management?

I. A collateral management system need not consider the failure by counterparties to returncollateral when due

II. The extent to which counterparties may have rehypothecated collateral is not aconsideration for a collateral management system

III. Cash is an acceptable substitute for any type of collateral required to be posted

IV. Haircuts do not apply to treasury issued instruments posted as collateral

A. I, II and III

B. I, II, III and IV

C. II and III

D. None of the statements is true

E. A collateral management system need not consider the failure by counterparties to returncollateral when due

II. The extent to which counterparties may have rehypothecated collateral is not aconsideration for a collateral management system

III. Cash is an acceptable substitute for any type of collateral required to be posted

IV. Haircuts do not apply to treasury issued instruments posted as collateral

ANSWER: D

Explanation:

:

Strong management of collateral, both receivable and payable, is emerging as an area requiring significant investment by financial institutions and asset managers in IT infrastructures and business processes. A bank needs to make collateral calls daily, based upon the P&L of the previous day, and likewise receives collateral calls from its counterparties. Just like cash, a bank needs to make sure that it does not run out of collateral to post when a call is received. Interestingly, based upon the agreements between banks and their mutual understanding, only certain types of instruments often qualify as valid collateral - and in such cases even cash is not acceptable if the right type of bond or other agreed security is not available to post. The operational challenges of managing collateral increase manifold due to 'rehypothecation', ie when collateral received from one counterparty gets posted out as collateral where it is due. In such cases, the bank should have the mechanisms to receive the right assets back in a timely way in case rehypothecated assets are to be returned. The systems should be able to deal with delays, failures without impacting the ability of the bank to post collateral as needed. All of this requires major investments in IT and processes.

Statement I is not true as a bank is bound to post collateral to third parties when needed regardless of the failure of its counterparties to post collateral to it when owed. In the markets, failures by counterparties can and do happen, and a collateral management system needs to account for and keep a buffer for the fact that some collateral when due will not be received.

Statement II is not true as rehypothecation by counterparties of collateral posted increases the chances of the collateral not being received in time. The system should consider the need for liquidity to generate assets that can be posted as collateral when others have failed to return the collateral in a timely way.

Statement III is not correct as cash may not be acceptable to counterparties as collateral. From a practical point of view, they may not have the infrastructure to receive and account for cash as collateral. A Swiss bank, for example, may have an 'account' to receive US tbills as collateral but may not even have a US dollar account to receive cash. Even if it did, the volumes of transactions going back and forth may make tracking and reconciliations impossible. Thus a bank should always make sure that it has the right type of collateral available to post.

Statement IV is incorrect as well, as treasury issued instruments are also subject to haircuts. Their value also fluctuates in response to changes in yields, and therefore they are subject to haircuts as well.

Thus none of the statements are correct and Choice 'd' is the correct answer.

QUESTION NO: 5

There are two bonds in a portfolio, each with a market value of $50m. The probability of default of the two bonds are 0.03 and 0.08 respectively, over a one year horizon. If the default correlation is 25%, what is the one year expected loss on this portfolio?

A. $1.38m B. $11m

B. $5.26m

C. $5.5mc

ANSWER: C

Explanation:

:

We will need to calculate the joint probability distribution of the portfolio as follows.Probability of the joint default of both A and B =

$$P(A\ defaults \cap B\ defaults) = (Default\ Correlation\ of\ A\&B) * \sqrt{\left(P(A)(1-P(A))\right)\left(P(B)(1-P(B))\right)} + P(A)P(B)$$

=25%*SQRT(0.03*(1 - 0.03)*0.08*(1 - 0.08)) + 0.03*0.08 = 0.0140.

The marginal probabilities (ie the standalone probabilities of default of the two bonds) are known, and if we can calculate the probability of joint defaults of the two bonds, we can calculate the rest of the entries. We then multiply the probabilities with the expected loss under each scenario and add them up to get the total expected loss.

The calculations are shown below. The expected loss is $5.5m, and therefore the correct answer is Choice 'd'.

Probabilities

	A defaults	A survives	Total
B defaults	**0.01397**	0.06603	**0.08**
B survives	0.01603	0.90397	0.92
Total	**0.03**	0.97	1

Loss in $m

	A defaults	A survives
B defaults	100.0000	50.0000
B survives	50.0000	0.0000

Expected loss in each scenario ($m)
(multiply the probability with the loss)

	A defaults	A survives
B defaults	1.3970	3.3015
B survives	0.8015	0.0000

Total expected loss = $ 5.5000 m

QUESTION NO: 6

A portfolio has two loans, A and B, each worth $1m. The probability of default of loan A is 10% and that of loan B is 15%. The probability of both loans defaulting together is 1%.

Calculate the expected loss on the portfolio.

A. 500000

B. 250000

C. 1000000

D. 240000

ANSWER: B

Explanation:

:

The easiest way to answer this question is to ignore the joint probability of default as that is irrelevant to expected losses. The joint probability of default impacts the volatility of the losses, but not the expected amount. One way to think about it is to think of asset portfolios, where diversification reduces risk (ie standard deviation) but the expected returns are nothing but the average of the expected returns in the portfolio. Just as the expected returns of the portfolio are not affected by the volatility or correlations (these affect standard deviation), in the same way the joint probability of default does not affect the expected losses. Therefore the expected losses for this portfolio are simply $1m x 10% + $1m x 15% = $250,000.

This can also be seen from the lens of a joint probability distribution as follows:

	Loan A defaults	Loan A survives	
Loan B defaults	1%	14%	**15%**
Loan B survives	9%	76%	**85%**
	10%	**90%**	

There are four possibilities for this portfolio:

- Only loan A defaults: loss of $1m: 9% probability

- Only loan B defaults: loss of $1m: 14% probability

- Both loan A and B default: loss of $2m: 1% probability

- Neither A nor B default: loss of $0m: 76% probability

Therefore the expected losses on the portfolio are ($1m x 9%) + ($1m x 14%) + ($2m x 1%) + ($0m x 76%) = $250,000.

(Notes: How is the above table calculated? The totals (10%, 90%, 15% and 85%) are filled in first. The top left cell (both A & B default) is given as 1%. We can now calculate the rest of the cells as the totals are known.)

QUESTION NO: 7

Which of the following measures can be used to reduce settlement risks:

A. escrow arrangements using a central clearing house

B. increasing the timing differences between the two legs of the transaction

C. providing for physical delivery instead of netted cash settlements

D. all of the above

ANSWER: C

Explanation:

: increasing the timing differences between the two legs of the transaction will increase settlement risk and not reduce it. Using escrow arrangements, such as central clearing houses to settle transactions (eg the DTCC in the United States) reduces settlement risk. Cash settlements based on netting arrangements reduce settlement risk, while physical delivery combined with gross cash payments increase it.

Therefore Choice 'a' is the correct answer.

QUESTION NO: 8

Which of the following statements are correct:

I. A training set is a set of data used to create a model, while a control set is a set of data isused to prove that the model actually works

II. Cleansing, aggregating or ensuring data integrity is a task for the IT department, and isnot a risk manager's responsibility

III. Lack of information on the quality of underlying securities and assets was a major causeof the collapse in the CDO markets during the credit crisis that started in 2007

IV. The problem of lack of historical data can be addressed reasonably satisfactorily byusing analytical approaches

A. II and IV

B. I, III and IV

C. I and III

D. All of the above

E. A training set is a set of data used to create a model, while a control set is a set of data isused to prove that the model actually works

II. Cleansing, aggregating or ensuring data integrity is a task for the IT department, and isnot a risk manager's responsibility

III. Lack of information on the quality of underlying securities and assets was a major causeof the collapse in the CDO markets during the credit crisis that started in 2007

IV. The problem of lack of historical data can be addressed reasonably satisfactorily byusing analytical approaches

ANSWER: C

Explanation:

: Statement I is correct. Data is often divided into two sets - a 'training set' that is used to create and fine-tune the model while the 'control set' is used to prove that the model works on sample data. Back testing is then perfomed using actual data that becomes available over time, or may already be available as historical data.

Statement II is incorrect. A risk manager often spends a great deal of time in managing data, and ensuring that the data being used is accurate enough for the purpose it is being used for. A risk manager can expect to spend a good part of his or

her team's time in cleansing data. While he or she can try to get the IT processes and systems to produce correct data in the first place so it requires minimal subsequent cleansing or validation, this task is likely to remain a key part of a risk manager's role for quite some time in the future given the challenges nearly all organizations face in managing risk data.

Statement III is correct. There was not enough granular data available on the underlying components of some of the derivative debt securities whose markets dried up during the crisis that began in 2007. This was because investors became increasingly unsure of what the value of these securities, such as CDOs was, leading to market seizure and firesale prices.

Statement IV is not correct. There is no easy solution to the lack of enough historical data, which is used to create as well as test models, and construct stress scenarios. Analytical approaches are not a good enough substitute for real market data. During the recent crisis, many instruments had rather short histories and there was not enough data available, and risk managers and portfolio managers relied upon analytical approaches to value and price them. Many of the assumptions that underpinned these approaches were untested in the real world and turned out to be incorrect.

Therefore Choice 'c' is the correct answer and the rest are incorrect.

QUESTION NO: 9

A long position in a credit sensitive bond can be synthetically replicated using:

A. a long position in a treasury bond and a short position in a CDS

B. a long position in a treasury bond and a long position in a CDS

C. a short position in a treasury bond and a short position in a CDS

D. a short position in a treasury bond and a long position in a CDS

ANSWER: A

Explanation:

:

The correct answer is choice 'a'

A long position in a credit sensitive bond is equivalent to earning the risk free rate and the spread on the bond. The risk free rate can be earned through a long position in a treasury bond, and the spread can be earned in the form of premiums on a CDS, which are received by the protection seller, ie the party short a CDS contract. Therefore we can get the same results as a long bond position using a combination of a long treasury bond and a short position in a CDS. Choice 'a' is the correct answer.

QUESTION NO: 10

According to the Basel framework, reserves resulting from the upward revaluation of assets are considered a part of:

A. Tier 3 capital

B. Tier 2 capital

C. Tier 1 capital

D. All of the above

ANSWER: B

Explanation:

:

According to the Basel II framework, Tier 1 capital, also called core capital or basic equity, includes equity capital and disclosed reserves.

Tier 2 capital, also called supplementary capital, includes undisclosed reserves, revaluation reserves, general provisions/general loan-loss reserves, hybrid debt capital instruments and subordinated term debt.

Tier 3 capital, or short term subordinated debt, is intended only to cover market risk but only at the discretion of their national authority.

QUESTION NO: 11

When pricing credit risk for an exposure, which of the following is a better measure than the others:

A. Expected Exposure (EE)

B. Notional amount

C. Potential Future Exposure (PFE)

D. Mark-to-market

ANSWER: A

Explanation:

:

Exposure for derivative instruments can vary significantly over the lifetime of the instrument, depending upon how the market moves. The potential future exposure represents the extremes, not the most likely outcome. The expected exposure is the most suitable measure for pricing the credit risk. Over time, as multiple transactions are entered into, the expectation (or the mean) will be realized - though individual transactions may have more or less by way of exposure.

The notional amount may not be relevant, though for loans it may be the most important contributor to the expected exposure. Mark-to-market will represent the exposure at a given point in time, but cannot be predicted nor be used to price the credit risk.

QUESTION NO: 12

The loss severity distribution for operational risk loss events is generally modeled by which of the following distributions:

I. the lognormal distribution

II. The gamma density function

III. Generalized hyperbolic distributions

IV. Lognormal mixtures

A. II and III

B. I, II and III

C. I, II, III and IV

D. I and III

E. the lognormal distribution

II. The gamma density function

III. Generalized hyperbolic distributions

IV. Lognormal mixtures

ANSWER: C

Explanation:

: All of the distributions referred to in the question can be used to model the loss severity distribution for op risk. Therefore Choice 'c' is the correct answer.

QUESTION NO: 13

Under the KMV Moody's approach to credit risk measurement, how is the distance to default converted to expected default frequencies?

A. Using a proprietary database based on historical information

B. Using migration matrices

C. Using a normal distribution

D. Using Monte Carlo simulations

ANSWER: A

Explanation:

:

KMV Moody's uses a proprietary database to convert the distance to default to expected default probabilities.

QUESTION NO: 14

Which of the following is a most complete measure of the liquidity gap facing a firm?

A. Residual liquidity gap

B. Liquidity at Risk

C. Marginal liquidity gap

D. Cumulative liquidity gap

ANSWER: A

Explanation:

:

Marginal liquidity gap measures the expected net change in liquidity over, say, a day. It is just equal to the liquidity inflow minus liquidity outflow. The cumulative liquidity gap measures the aggregate change in liquidity from a point in time, in other words it is just the summation of the marginal liquidity gap for each of the days included in the period under consideration. The residual liquidity gap goes one step further and adds available 'opening balance' of liquidity to the cumulative liquidity gap to reveal the days or times when the net liquidity is most at risk.

Liquidity at Risk measures the expected time to survival at a certain confidence level applied to the firm's cash flows - and is not a measure of the liquidity gap.

Therefore Choice 'a' is the correct answer.

QUESTION NO: 15

Which of the following is true in relation to Principal Component Analysis (PCA)?

I. An n x n positive definite square matrix will have n-1 eigenvectors

II. The eigenvalues for a correlation matrix can be derived from the corresponding valuesfor the covariance matrix

III. Principal components are uncorrelated to each other

IV. PCA is useful as it allows 100% of the variation in a complex system to be explained bythe first three principal components

A. I and III

B. I, II and IV

C. III and IV

D. III

E. An n x n positive definite square matrix will have n-1 eigenvectors

II. The eigenvalues for a correlation matrix can be derived from the corresponding valuesfor the covariance matrix

III. Principal components are uncorrelated to each other

IV. PCA is useful as it allows 100% of the variation in a complex system to be explained bythe first three principal components

ANSWER: D

Explanation:

:

An n x n positive definite square matrix will have n eigenvectors, and not n - 1. Therefore statement I is incorrect.

A correlation and covariance matrix are related to each other through the matrix of standard deviations. If the covariance matrix is represented by V, the correlation matrix by C and D is the diagonal matrix of standard deviations, then V = DCD. However, there is no simple relationship between the eigenvalues of the two matrices, and it is not possible to derive the eigenvalues for one given the eigenvalues for the other. Therefore statement II is false.

Principal components are uncorrelated to each other. That is correct, and in fact PCA is useful because of this being so. Statement III is therefore true.

PCA does not explain 100% of the variation in a system with just three components statement IV is false. (Remember though that most (though not 100%) of the variation in a system of term structures is explained by the first three components - trend, tilt and curvature).

Thus Choice 'd' is the correct answer.