Sample Exam

(Excerpted from the *Financial Risk Manager Handbook* (2nd edition), by Philippe Jorion, 2003, John Wiley & Sons.)

Chapter 04

Example 1: FRM Exam 1999-Question 18/Quant. Analysis

(1).If S1 follows a geometric Brownian motion and S2 follows a geometric Brownian motion, which of the following is true?

a) Ln(S1+S2)is normally distributed.
b) S1*S2 is lognormally distributed.
c) S1*S2 is normally distributed.
d) S1+S2 is normally distributed.

Example 2: FRM Exam 1999-Question 26/Quant. Analysis

(2). The Vasicek model defines a risk-neutral process for r which is $dr = a(b - r)dt + \sigma dz$, where a, b, and σ are constant, and r represents the rate of interest. The term a(b - r) represents which term?

a) Gamma b) Stochastic c) Reversion d) Vega

Example 3: FRM Exam 1999-Question 30/Quant. Analysis

(3). For which of the following currencies would it be most appropriate to choose a lognormal interest rate model over a normal model?

a) USD b) JPY c) EUP d) GBP

Example 4: FRM Exam 2001-Question 76

(4). A martingale is a

a) Zero-drift stochastic process
b) Chaos-theory-related process
c) Type of time series
d) Mean-reverting stochastic process

Example 5: FRM Exam 1999-Question 8/Quant. Analysis

(5). Several different estimates of the VAR of an options portfolio were computed using 1,000 independent, lognormally distributed samples of the underlyings. Because each estimate was made using a different set of random numbers, there was some variability in the answers; in fact, the standard deviation of the distribution of answers was about $100,000. It was then decided to re-run the VAR calculation using 10,000 independent samples per run. The standard deviation of the reruns is most likely to be

a) About $10,000

b) About $30,000
c) About $100,000 (i.e., no change from the previous set of runs)
d) Cannot be determined from the information provided

Example 6: FRM Exam 1997-Question 17/Quant. Analysis

(6). The measurement error in VAR, due to sampling variation, should be greater with

a) More observations and a high confidence level (e.g. 99%)
b) Fewer observations and a high confidence level
c) More observations and a low confidence level (e.g. 95%)
d) Fewer observations and a low confidence level

Example7: FRM Exam 1999-Q.uestion 29/Quant. Analysis

(7). Given the covariance matrix,

$$\Sigma=\begin{pmatrix} 0.09\% & 0.06\% & 0.03\% \\ 0.06\% & 0.05\% & 0.04\% \\ 0.03\% & 0.04\% & 0.06\% \end{pmatrix}$$

Let$\Sigma=XX'$, where X is lower triangular, be a Cholesky decomposition. Then the four elements in the upper left-hand corner of X, $X_{11,}$ $X_{12,}$ $X_{21,}$ $X_{22,}$ are, respectively,

a)3.0%,0.0%,4.0%,2.0% b)3.0%,4.0%,0.0%,2.0%
c)3.0%,0.0%,2.0%,1.0% d)2.0%,0.0%,3.0%,1.0%

Chapter 11

Example 8: FRM Exam 1999-Question 89/Market Risk

(8). What is the correct interpretation of a $3 million overnight VAR figure with 99% confidence level? The institution

a) Can be expected to lose at most $3 million in 1 out of next 100 days
b) Can be expected to lose at least $3 million in 95 out of next 100days
c) Can be expected to lose at least $3 million in 1 out of next 100days
d) Can be expected to lose at most $6 million in 2 out of next 100days

Example 9: FRM Exam 1998-Question 22/Capital Markets

(9). Considering arbitrary portfolios A and B, and their combined portfolio C, which of the following relationships always holds for VARs of A, B and C?

a) $VAR_A+VAR_B=VAR_C$
b) $VAR_A+VAR_B \geqq VAR_C$
c) $VAR_A+VAR_B \leqq VAR_C$
d) None of the above

Example 10: FRM Exam 1997-Question 23/Regulatory

(10). The standard VAR calculation for extension to multiple periods also assumes that positions are fixed. If risk management enforces loss limits, the true VAR

will be

a) The same
b) Greater than calculated
c) Less than calculated
d) Unable to be determined

Example 11: FRM Exam 1997-Question 9/Regulatory

(11). A trading desk has limits only in outright foreign exchange and outright interest rat risk. Which of the following products can not be traded within the current limit structure?

a) Vanilla interest rate swaps, bonds, and interest rate futures
b) Interest rate futures, vanilla interest rate swaps, and callable interest rate swaps
c) Repos and bonds
d) Foreign exchange swaps, and back-to-back exotic foreign exchange options

Example 12: FRM Exam 1998-Question 20/Regulatory

(12). VAR measures should be supplemented by portfolio stress-testing because

a) VAR measures indicate that the minimum loss will be the VAR; they don't indicate how large the losses can be.
b) Stress-testing provides a precise maximum loss level.
c) VAR measures are correct only 95% of the time.
d) Stress-testing scenarios incorporate reasonably probable events.

Chapter17

Example 13: FRM Exam 2001 Question 92

(13). Under usually accepted rules of market behavior, the relationship between parametric delta-normal VAR and historical VAR will tend to be:

a) Parametric VAR will be higher.
b) Parametric VAR will be lower.
c) It depends on the correlations.
d) None of the above are correct.

Example 14: FRM Exam 1997-Question 12/Risk Measurement

(14). Delta-normal, historical simulation, and Monte Carlo are various methods available to compute VAR. If underling returns are normally distributed, then the

a) Delta-normal method VAR will be identical to the historical-simulation VAR.
b) Delta-normal method VAR will be identical to the Monte-Carlo VAR.
c) Monte-Carlo VAR will approach the delta-normal VAR as the number of replications ("draws") increases.
d) Monte-Carlo VAR will be identical to the historical-simulation VAR.

Example 15: FRM Exam 1999-Question 82/Market Risk

(15). Bank London with substantial position in 5-year AA-grade Eurobonds has recently launched an initiative to calculate 10 day spread VAR. As a risk manager for the Eurobond trading desk you have been asked to provide an estimate for the AA-spread VAR. The extreme move used for the gilts yield is40bp, and for the Eurobond yield is 50bp. These are based on the standard deviation of absolute (not proportional) changes in yields. The correlation between changes in the two is 89. What is the extreme move for the spread?

a) 19.3 5bp b) 14.95bp c) l0bp d) 23.24bp

Chapter18

Example 16: FRM Exam 2000-Question 36/Credit Risk

(16). Settlement risk m foreign exchange is generally due to

a) Notionals being exchanged
b) Net value being exchanged
c) Multiple currencies and countries involved
d) High volatility of exchange rates

Example 17: FRM Exam 2000-Question 85/Market Risk

(17). Which one of the following statements about multilateral netting systems is not accurate?

a) Systemic risks can actually increase because they concentrate risks on the central counterparty, the failure of which exposes all participants to risk.
b) The concentration of risks on the central counterparty eliminates risk because of the high quality of the central counterparty.
c) By altering settlement costs and credit exposures, multilateral netting systems for foreign exchange contracts could alter the structure of credit relations and affect competition in the foreign exchange markets.
d) In payment netting systems, participants with net-debit positions will be obligated to make a net settlement payment to the central counterparty that, in turn, is obligated to pay those participants with net credit positions.

Example 18: FRM Exam 1998-Question 38/Credit Risk

(18). Calculate the probability of a subsidiary and parent company both defaulting over the next year. Assume that the subsidiary will default if the parent defaults, but the parent will not necessarily default if the subsidiary defaults. Also assume that the parent has a 1-year probability of default of 0.5% and the subsidiary has a 1-year probability of default of 0.90%.

a) 0.450% b) 0.500% c) 0.545% d) 0.550%

Example 19: FRM Exam 2000-Question 51/Credit Risk

(19). A portfolio consists of two (long) assets £ 100 million each. The probability of default over the next year is 10% for first asset, 20%or the second asset, and the joint probability of default is 3%. Estimate the expected loss on this portfolio due

to credit defaults over the next year assuming 40% recovery rate for bath assets.

a) £ 18 million b) £ 22 million c) £ 30 million d) None of the above

Example 20: FRM Exam 2001-Question 5

(20). what is the approximate probability of one particular bond defaulting, and none of the others, over the next year from a portfolio of 20 BBB-rated obligors? Assume the 1-year probability of default for a BBB-rated counterparty to be 4% and obligor defaults to be independent from one another.

a) 2% b) 4% c) 45% d) 96%

Chapter22

Example 21: FRM Exam 1999-Question 122/Credit Risk

(21). A portfolio manager holds a default swap to hedge an AA corporate bond position. If the counterparty of the default swap is acquired by the bond issuer, then the default swap:

a) Increases in value
b) Decreases in value
c) Decreases in value only if the corporate bond is downgrade
d) Is unchanged in value

Example 22: FRM Exam 2000-Q.uestion 39/Credit Risk

(22). A portfolio consists of one (long) $100 million asset and a default protection contract on this asset. The probability of default over the next year is10 for the asset and 20 for the counterparty that wrote the default protection. The joint probability of default for the asset and the contract counterparty is 3.Estimate the expected loss on this portfolio due to credit defaults over the next year assuming 40 recovery rate on the asset and 0 recovery rate for the contract counterparty.

a) $3.0 million b) $2.2 million
c) $1.8 million d) None of the above

Example 23: FRM Exam 1999-Question 113/Credit Risk

(23). Which of the following statements is/are always true?

a) Payment in a credit swap is contingent upon a future credit event.
b) Payment in a total rate of return swap is not contingent upon a future credit event.
c) Both (a) and (b) are true.
d) None of the above are true.

Example 24: FRM Exam 2000-Question 61/Credit Risk

(24). (Complex-use the valuation formula with prices) A credit-spread option has a notional amount of $50 million with a maturity of one year. The underlying security is a IO-year, semiannual bond with a 7 coupon and a$1,000 face value. The current spread is 120 basis points against 10-year Treasuries. The option is

a European option with a strike of 130 basis points. If at expiration, Treasury yields have moved from 6 to 6.3 and the credit-spread has widened to 150 basis points, what will be the payout to the buyer of this credit-spread option?

a) $587,352 b) $611,893
c) $622,426 d) $639,023

Example 25: FRM Exam 2000-Question 62/Credit Risk

(25). Bank One has made a $200 million loan to a software company at a fixed rate of 12 percent. The bank wants to hedge its exposure by entering into a total return swap with a counterparty, Interloan Co., in which Bank One promises to pay the interest on the loan plus the change in the market value of the loan in exchange for LIBOR plus 40 basis points. If after one year the market value of the loan has decreased by 3 percent and LIBOR is II percent, what will be the net obligation of Bank One?

a) Net receipt of $4.8 million
b) Net payment of $4.8 million
c) Net receipt of $5.2 million
d) Net payment of $5.2 million

Example 26: FRM Exam 1999-Question 135/Credit Risk

(26). The Widget Company has outstanding debt of three different maturities as outlined in the table.

Maturity	Widget Company Bonds Price Coupon(30/360)	Corresponding U.S. Treasury Bonds Price Coupon(30/360)
1 year 5 year 10 year	100 7.00% 100 8.50% 100 9.50%	100 6.00% 100 6.50% 100 7.00%

All Widget Co. debt ranks pari passu, all its debt contains cross default provisions, and the recovery value for each bond is 20. The correct price for a one-year credit default swap (30/360) with the Widget Co., 9.5% 10-year bond as a reference asset is

a)1.0% per annum b)2.0% per annum
c)2.5% per annum d)3.5% per annum

Example 27: FRM Exam 2000-Question 30/Credit Risk

(27). Which one of the following statements is not an application of credit derivatives for banks?

a) Reduction in economic and regulatory capital usage
b) Reduction in counterparty concentrations
c) Management of the risk profile of the loan portfolio

d) Credit protection of private banking deposits

Chapter 23

Example 28: FRM Exam 1998-Question 39/Credit Risk

(28). Calculate the 1-yeat expected loss of a $100 million portfolio comprising 10 B-rated issuers. Assume that the 1-year probability of default for each issuer is 6% and the average recovery value for each issuer in the event of default is 40%.

a) $2.4 million b) $3.6 million
c) $24 million d) $36 million

Example 29: FRM Exam 1999-Question 120/Credit Risk23-3.

(29).Which loan is more risky? Assume that the obligors are rated the same, are from the same industry, and have more or less same sized idiosyncratic risk. A loan of

a) $1,000,000 with 50% recovery rate
b) $1,000,000 with no collateral
c) $4,000,000 with 40% recovery rate
d) $4,000,000 with 60% recovery rate

Example 30: FRM Exam 1998-Question 10/Credit Risk

(30). A risk analyst is trying to estimate the credit VAR for a portfolio of two risky bonds. The credit VAR is defined as the maximum unexpected loss at a confidence level of 99.9% over a one-month horizon. Assume that each bond is valued at $500,000 one month forward, and the one-year cumulative default probability is 2% for each of these bonds. What is your best estimate of the credit VAR for this portfolio, assuming no default correlation and no recovery?

a) $841 b) $1,682 c) $998,318 d) $498,318

Example 31: FRM Exam 2001-Question 27

(31). What can be said about default correlations in CreditMetrics?

a) Default correlations can be estimated by ratings changes.
b) Firm-specific aspects are more important than correlation.
c) Past history is insufficient to judge default correlations.
d) Default correlations can be estimated by equity valuation.

Example 32: FRM Exam 1999-Question 145/Credit Risk

(32). J.P. Morgan's CreditMetrics uses which of the following to estimate default correlations?

a) CreditMetrics does not estimate default correlations; it assumes zero correlations between defaults.
b) Correlations of equity returns are used.
c) Correlations between changes in corporate bond spreads to treasury are used.
d) Historical correlation of corporate bond defaults are used.

Example 33: FRM Exam 2000-Question 44/Credit Risk23-12.
Which one of the following statements regarding credit risk models is most correct?

a) The CreditRisk+ model decomposes all the instruments by their exposure and assesses the effect of movements in risk factors on the distribution of potential exposure.
b) The CreditMetrics model provides a quick analytical solution to the distribution of credit losses with minimal data input.
c) The KMV model requires the historical probability of default based on the credit rating of the firm.
d) The Credit Portfolio View (McKinsey) model conditions the default rate on the state of the economy.

Answer to Sample Examples

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
b	**c**	**b**	**a**	**b**	**b**	**c**	**c**	**d**	**c**
(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
b	**a**	**b**	**c**	**d**	**a**	**b**	**b**	**a**	**a**
(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
b	**c**	**c**	**c**	**a**	**d**	**d**	**b**	**c**	**d**
(31)	(32)	(33)							
a	**d**	**b**							

Chapter 04

Example 1: FRM Exam 1999-Question 18/Quant. Analysis

b) Both S1 and S2 are lognormally distributed since *d*ln(S1) and *d*ln(S2) are normally distributed. Since the logarithm of (S1*S2) is also its sum, it is also normally distributed and the variable S1*S2 is lognormally distributed.

Example 2: FRM Exam 1999-Question 26/Quant. Analysis

c) This represents the expected return with mean reversion.

Example 3: FRM Exam 1999-Question 30/Quant. Analysis

b) (*This requires some knowledge of markets*) Currently, yen interest rates are very low, the lowest of the group. This makes it important to choose a model that, starting from current rates, does not allow negative interest rates, such as the lognormal model.

Example 4: FRM Exam 2001-Question 76

a) A martingale is a stochastic process with zero drift $dx = \sigma dz$, where dz is a Wiener process, i.e. such that $dz \sim N(0, dt)$. The expectation of future value is the current value: $E[X_T] = X_0$, so it cannot be mean-reverting.

Example 5: FRM Exam 1999-Question 8/Quant. Analysis

b) Accuracy with independent draws increases with the square root of K. Thus multiplying the number of replications by a factor of 10 will shrink the standard errors from 100,000 to $100.000/\sqrt{10}$, or to approximately 30,000.

Example 6: FRM Exam 1997-Question 17/Quant. Analysis

b) Sampling variability (or imprecision) increases with (i) fewer observations and (ii) greater confidence levels. To show (i), we can refer to the formula for the precision of the sample mean, which varies inversely-with the square root of the number of data points. A similar reasoning applies to (ii). A greater confidence level involves fewer observations in the left tails, from which VAR is computed.

Example 7: FRM Exam 1999-Question 29/Quant. Analysis

c)(Data-intensive)This involves a Cholesky decomposition. We have XX'=

$$\begin{bmatrix} X_{11} & 0 & 0 \\ X_{21} & X_{22} & 0 \\ X_{31} & X_{32} & X_{33} \end{bmatrix} \begin{bmatrix} X_{11} & X_{21} & X_{31} \\ 0 & X_{22} & X_{32} \\ 0 & 0 & X_{33} \end{bmatrix} = \begin{bmatrix} X_{11}^2 & X_{11}X_{21} & X_{11}X_{33} \\ X_{21}X_{11} & X_{21}^2 + X_{22}^2 & X_{21}X_{31} + X_{22}X_{32} \\ X_{31}X_{11} & X_{31}X_{21} + X_{32}X_{22} & X_{31}^2 + X_{32}^2 + X_{33}^2 \end{bmatrix}$$

$$\Sigma = \begin{pmatrix} 0.09\% & 0.06\% & 0.03\% \\ 0.06\% & 0.05\% & 0.04\% \\ 0.03\% & 0.04\% & 0.06\% \end{pmatrix}$$

We then laboriously match each term, $(X_{11})^2$=0.0009, or X_{11}=0.03.Next, X_{12}=0 since this is in the upper right corner, above the diagonal. Next, $X_{11}X_{21}$=0.0006, or X_{21}=0.02. Next, $(X_{21})^2+(X_{22})^2$=0.0005, or X_{22}=0.01.

Chapter 11

Example 8: FRM Exam 1999-Question 89/Market Risk

c) There will be a loss worse than VAR in, on average, n = 1 x 100 = I day out of 100.

Example 9: FRM Exam 1998-Question 22/Capital Markets

d) This is the correct answer given the "always" requirement and the fact that VAR is not always subadditive. Otherwise, (b) is not a bad answer, but it requires some additional distributional assumptions.

Example 10: FRM Exam 1997-Question 23/Regulatory

c) Less than calculate. Loss limits cut down the positions as losses accumulate. This is similar to a long position in an option, where the delta increases as the price increase, and vice versa. Long positions in options have left tails, and hence involve less risk than an unprotected position,

Example 11: FRM Exam 1997-Question 9/Regulatory

b) Callable interest rate swaps involve options, for which there is no limit. Also note that back-to-back options are perfectly hedged and have no market risk.

Example 12: FRM Exam 1998-Question 20/Regulatory

a) The goal of stress-testing is to identify losses that go beyond the “normal” losses measured by VAR.

Chapter 17

Example13: FRM Exam 2001-Question 92

b) Parametric VAR usually assumes a normal distribution. Given that actual distributions of financial variables have fatter tails than .the normal distribution, parametric VAR at high confidence levels will generally underestimate VAR.

Example 14: FRM Exam 1997-Question 12/Risk Measurement

c) In finite samples, the simulation methods will be in general differ from the delta-normal method, and from each other. As the sample size increase, however, the Monte-Carlo VAR should converge to the delta-normal VAR when returns are normally distributed.

Example 15: FRM Exam 1999-Q.uestions 82/Market Risk

d) VAR= $\sqrt{40^2+50^2-2\times40\times50\times0.89}$ = 23.24

Chapter 18

Example16: FRM Exam 2000-Q.uestion 36/Credit Risk

a) Settlement risk is due to the exchange of notional principal in different currencies at different points in time, which exposes one counterparty to default after it has made payment. There would be less risk with netted payments.

Example 17: FRM Exam 2000-Question 85/Market Risk

b) Answers (c) and (d) are both correct. Answers (a) and (b) are contradictory. A multilateral netting system concentrates the credit risk into one institution. This could potentially create much damage if this institution fails.

Example18: FRM Exam 1998-Question 38/Credit Risk

b) Since the subsidiary defaults when the parent defaults, the joint probability is simply that of the parent defaulting.

Example 19: FRM Exam 2000-Q.uestion 51/Credit Risk

a) The three loss events are

(i) Default by the first alone, with probability 0.10 - 0.03 = 0.07

(ii) Default by the second, with probability 0.20 - 0.03 = 0.17

(iii) Default by both, with probability 0.03

The respective losses are £100 × (1- 0.4) × 0.07 == 4.2, £100 × (1- 0.4) × 0.17 = 10.2, £200×(I - 0.4)×0.03 = 3.6, for a total expected loss of £18 million.

Example 20: FRM Exam 2001-Question 5

a) This question asks the probability that one particular bond will default and 19 others will not. Assuming independence, this is $0.04(1-0.04)^{19} = 1.84$. Note that the probability that any bond will default and none others is 20 times this, or 36.8%

Chapter22

Example 21: FRM Exam 1999-Question 122/Credit Risk

b) This is an interesting question that demonstrates that the credit risk of the underlying asset is exchange for that of the swap counterparty. The swap is now worthless; if the underlying credit defaults, the counterparty will default as well (since it is the same).

Example 22: FRM Exam 2000-Question 39/Credit Risk

c) The only state of the world with a loss is a default on the asset jointly with a default of the guarantor. This has probability of 3%. The expected loss is $100,000,000 x 0.03 x (1-40%) = $1.8 million.

Example 23: FRM Exam 1999-Question 113/Credit Risk

c) Payment from the protection seller is contingent upon a credit event for a credit swap and a combination of payment tied to a reference rate and the asset depreciation for a TRS.

Example 24: FRM Exam 2000-Question 61/Credit Risk

c) We need to value the bond with remaining semiannual payments for 9 years using two yields, y+s=6.30+1.50=7.80%and y+K=6.30+1.630=7.60%. This gives $948.95 and $961.40, respectively, the total payout is the $50,000,000*[$961.40-948.95]/$1000=$622,424.

Example 25: FRM Exam 2000-Question 62/Credit Risk

a) The net payment is an outflow of 12%-3% minus inflow of 11%+ 0.4%, which is a net receipt of -2.4%. Applied to the notional of $200 million, this gives a receipt of$4.8 million.

Example 26: FRM Exam 1999-Question 135/Credit Risk

a) Because all bonds rank equally, all default occur at the same time and have the same loss given default, therefore the cash flow on the 1-year credit swap can replicated (including any risk premium) by going long the 1-year Widget bond and short the 1-year T-Bond.

Example 27: FRM Exam 2000-Question 30/Credit Risk

d) Credit derivatives are used to reduce regulatory capital usage and counterparty concentrations and to manage the risk profile of the loan portfolio. Private banking deposits are bank liabilities, not assets.

Chapter23

Example 28: FRM Exam 1998-Question 39/Credit Risk

b) The expected loss is $100,000,000 x 0.06 x (I - 0.4) = $3.6 million. Note that correlations across obligors does not matter for expected credit loss.

Example 29: FRM Exam 1999-Question 120/Credit Risk

c) The exposure times the loss given default is, respectively, $500,000, $1,000,000, $2,400,000, and $1,600,000. Loan (c) has the most to lose.

Example 30: FRM Exam 1998-Question 10/Credit Risk

d) As in the previous question, the monthly default probability is 0.0168. The following table shows the distribution of credit losses.

Default	Probably(p_i)	Loss L_i	p_iL_i	1- Σ p_i
2 bonds	d^2 =0.00000282	$1,000,000	$2.8	100.00000%
1 bond	2d(1-d) =0.00335862	$500,000	$1,679.3	99.99972%
0 bond	$(1-d)^2$ =0.99663854	$0	$0.0	99.66385%
Total	1.00000000		$1,682.1	

This gives an expected loss of $1,682, the same as before. Next, $500,000 is the WCL at a minimum 99.9% confidence level because the total probability of observing a number equal to, or lower than this, is greater then 99.9%. The CVAR is then $500,000-$l,682=$498,318.

Example 31: FRM Exam 2001-Question 27

a) Correlations are important drivers of portfolio risk, so (b) is wrong. In CreditMetrics, correlations in asset values drive correlations in ratings change, which drive default correlations. Answer (d) is not correct as it refers to the Merton model, where default probabilities are inferred from equity valuation, liabilities, and volatilities.

Example 32: FRM Exam 2000-Question 44/Credit Risk

d) Answer (d) is most correct. Answer (a) is wrong because CreditRisk + assumes fixed exposures. Answer (b) is also wrong because CreditMetrics is a simulation, not analytical model. Finally, KMV uses the current stock price and not the historical default rate.

Example 33: FRM Exam 1999-Question 145/Credit Risk

b) CreditMetrics infers the default correlation from equity correlations.