



**National University of
Science and Technology**
Think in Other Terms



**FACULTY OF COMMERCE
DEPARTMENT OF FINANCE
BACHELOR OF COMMERCE HONOURS DEGREE IN FINANCE
RISK ANALYSIS [CFI 4104]
SUPPLEMENTARY EXAMINATIONS 2015
TIME ALLOWED: 3 HOURS**

Instructions to Candidates

1. Answer any **FOUR (4)** questions
2. Show **ALL** calculations

Information for candidates

1. The paper consists of five printed pages
2. All **six (6)** questions carry **25 marks** each

QUESTION ONE

- (a) Consider a portfolio consisting of stocks and bonds. The expected return on the portfolio's stock portion is 12%, and the standard deviation is 22%. The expected return on the bond portion is 5%, and the standard deviation is 7%. All of these figures are annual. The correlation between the two asset classes is 0.15. The portfolio's market value is \$150 million, with 65% being allocated to stocks. Determine the portfolio's Value-at-Risk (VaR) using the variance-covariance method for the following cases:
- i. A 95% confidence level (CL) yearly VaR **(4 marks)**
 - ii. A 99% CL yearly VaR **(4 marks)**
 - iii. A 95% CL weekly VaR **(4 marks)**
 - iv. A 99% CL weekly VaR **(4 marks)**
- (b) An organisation's 1-day 95% confidence level VaR shows a number fairly consistently around \$3 million. A backtest of the calculation shows that, as expected under the calculation, daily portfolio losses in excess of \$3 million tend to occur about once a month. When such losses do occur, however, they typically are more than double the VaR estimate. The portfolio contains a very large short options position. Based on this information:
- i. Is the VaR calculation accurate? **(3 marks)**
 - ii. How can the VaR figure best be interpreted? **(3 marks)**
 - iii. What additional measures might the organisation take to increase the accuracy of its overall exposure assessments? **(3 marks)**

Total = 25 marks

QUESTION TWO

- (a) The following information relates to a portfolio comprising of two assets A and B:

	A	B
Percentage invested	0.75	0.25
Expected annual return	0.12	0.18
Standard deviation	0.20	0.40
Correlation coefficient	0.90	

- Calculate the portfolio's standard deviation **(4 marks)**
- (b) Discuss the properties of variance and expected values. **(8 marks)**
- (c) Given a portfolio of two risky assets X and Y that are normally distributed, where **a** is the weight of X and **b** is the weight of Y, show that the portfolio

variance is simply the sum of the variances of the individual securities multiplied by the square of their weights plus a third term that includes the covariance of X and Y. **(9 marks)**

- (d) The variance of X is 0.0076 and that of Y is 0.00708. The covariance of these two assets is -0.0024. Calculate the correlation coefficient of the two assets.

(4 marks)

Total = 25 marks

QUESTION THREE

- (a) Evaluate the appropriateness of exponential moving averages to estimate future volatility of financial market risk factors. **(8 marks)**

- (b) The current estimate of daily volatility is 1.5%. The closing price of an asset yesterday was \$30.00. The closing price of the asset today is \$30.50. Using the exponentially weighted moving average model with $\lambda=0.94$, update the volatility estimate. **(5 marks)**

- (c) Where a backtest has been done and excession percentages are within tolerable levels as determined by the confidence level, there is still need to probe further. Discuss two reasons for probing further. **(12 marks)**

Total = 25 marks

QUESTION FOUR

- (a) A bank has booked a loan with a total commitment of \$50 000 of which 80% is currently outstanding. The default probability of the loan is assumed to be 2% for the next year and loss given default (LGD) is 50%. The standard deviation of LGD is 40%. Drawdown on default (the fraction of the undrawn loan) is estimated to be 60%. Calculate both the expected and unexpected losses for the bank. **(3; 3 marks)**

- (b) Consider an A-rated and a BBB-rated bond whose one year probabilities of default are 2% and 4% respectively. The joint probability of default of the two bonds is 0.15%. Calculate the default correlation between the two bonds. **(3 marks)**

- (c) Suppose Bank BNP lends \$1 million to X and \$5 million to Y. Over the next year, the probability of default (PD) for X is 0.2 while that for Y is 0.3. The PD of joint default is 0.1. The LGD for X is 40% and that for Y is 60%. Calculate the one year expected loss of default for the bank. **(3 marks)**

- (d) Suppose Bank XYZ lends to two different obligors that are rated BBB for one year. The one-year probability of default for a BBB rated obligor is 10%. Assuming zero correlation between the obligors' probability of defaulting, calculate the probability that both obligors will default in the same year.

(3 marks)

- (e) Calculate the loss given default for a loan granted by Bank XYZ to Robust Enterprises given the following information;

Interest accrued to date = \$2 million

Recovery rate = 50%

Amount of loan outstanding = \$40 million

No-default loan value = \$50 million

(5 marks)

- (f) Consider a company with the following financial ratios:

EBIT/ Total Assets = 0.2 Sales/ Total Assets = 1.4 Equity/ Book Debt = 0.9

Retained Earnings/ Total Assets = 0.4 Working Capital/Total Assets = 0.12

Required

Calculate the company's Z-score and comment on its creditworthiness.

(3; 2 marks)

Total = 25 marks

QUESTION FIVE

For a stress test to be deemed good, it must possess certain attributes. Examine any five of these attributes.

(25 marks)

QUESTION SIX

- (a) Explain why the delta normal approach is not suitable for measuring options portfolio risk.

(3 marks)

- (b) Suppose a financial institution in the US has the following three positions in options on the Australian dollar:

- ✓ A long position in 100 000 call options with a strike price of 0.55 and an expiration date in three months. The delta of each position is 0.533.

- ✓ A short position in 200 000 call options with a strike price of 0.56 and an expiration date in five months. The delta of each option is 0.468.
- ✓ A short position in 50 000 put options with a strike price of 0.56 and an expiration date in two months. The delta of each option is 0.508.

Calculate the portfolio's delta.

(4 marks)

- (c) A bank has sold \$300 000 of call options on 100 000 equities. The equities trade at \$50 and the strike price is \$50, the maturity is in 3 months, volatility is 20% and the interest rate is 5%. Calculate the delta of this position.

(3 marks)

- (d) What does it mean to assert that the theta of an option position is -0.1 when time is measured in years?

(3 marks)

- (e) 'If a bond portfolio exhibits positive convexity, any surprises in the portfolio's change in value as interest rates change are good surprises whereas the surprises are not so pleasant with negative convexity'. Explain this statement with the aid of a diagram.

(12 marks)

Total = 25 marks

END OF EXAMINATION PAPER