Strathmore
UNIVERSITY

STRATHMORE BUSINESS SCHOOL

MASTER OF SCIENCE IN DEVELOPMENT FINANCE

END OF SEMESTER EXAMINATION

MDF 8105: FINANCIAL RISK MANAGEMENT

Date: Thursday, 26th June 2018 **Time**: 3 Hours

Instructions

1. Answer question **ONE** and **ANY OTHER TWO** questions.
2. Marks will be awarded on the basis of clear exposition of your ideas, precision in the use of language and the validity of your logic.
3. Where relevant, show all your workings on the answer sheet provided.

QUESTION 1 (Compulsory) (30 Marks)

Part A: *(*14 Marks*)*

1. A bank's foreign loan portfolio contains a large concentration of loans to a country whose government has been running large external deficits. Evaluate the transfer risk that may exist in the event of stress. Will the greatest concern should be given to imports, interest rates, exports or currency convertibility? Explain your reasoning. **(2 Marks)**

2. The proper selection of factors to include in an ordinary least squares estimation is critical to the accuracy of the result. Briefly explain when does the omitted variable bias occur?

   (2 Marks)

3. The table below gives the closing prices and yields of a particular liquid bond over the past few days:

Day	Price	Yield
Monday	106.3	4.25%
Tuesday	105.8	4.20%
Wednesday	106.1	4.23%

   Determine the approximate duration of the bond. **(2 Marks)**

4. For a sample of 400 firms, the relationship between corporate revenue (Y_i) and the average years of experience per employee (X_i) is modelled as follows:

$Y_i = \beta_1 + \beta_2 X_i + \varepsilon_i$ where i=1,2,….400

You wish to test the joint null hypothesis that $\beta_1 = 0$ and $\beta_2 = 0$ at the 95% confidence interval. The p-value for the t-statistic for β_1 is 0.07 and the p-value for β_2 is 0.06. The p-value for the F-statistic for the regression is 0.045. What conclusion can you make?

(2 Marks)

5. Firms commonly incentivize their management to increase the firm's value by granting managers securities tied to the firm's stock. Some securities, however, can reduce managerial incentives to manage risk within the firm. From a risk perspective, explain, with reasons, whether the security issued is likely to be a deep-in-the money call option or deep-out-of the money call option on the firm's stock. **(2 Marks)**

6. Peter Paul is an investment advisor at Marshal Investment Advisors (MIA). Peter is advising Michael Jenkins, a high net worth individual. Michael would like to invest USD 500,000 in a bond rated at least AA. Peter is considering bonds issued by IBM, GE and Microsoft, and wants to choose a bond that satisfies Michael's rating requirement, but also has the highest yield to maturity. He has access to the following information:

	IBM	GE	Microsoft
S&P Bond Rating	AA+	A+	AAA
Semi-annual coupon	1.75%	1.78%	1.69%
Term to maturity in years	5	5	5
Price (USD)	975	973	989
Par value (USD)	1,000	1,000	1,000

With valid reasons, advise on which bond Peter should purchase for Michaels. **(2 Marks)**

7. Consider a 2-year, 6% semi-annual coupon bond currently yielding 5.2% on a bond equivalent basis. The Macaulay Duration of the bond is 1.92 years. Calculate its Modified Duration. **(2 Marks)**

Part B: **(16 Marks)**

8. You are provided with the following one-year transition matrix.

Initial Rating	**Rating at year-end**							
	AAA	AA	A	BBB	BB	B	CCC	Default
AAA	92.81%	6.33%	0.68%	0.06%	0.12%	0.00%	0.00%	0.00%
AA	0.70%	89.65%	8.79%	0.64%	0.06%	0.14%	0.02%	0.00%
A	0.09%	2.27%	91.05%	5.52%	0.74%	0.26%	0.01%	0.06%
BBB	0.02%	0.33%	6.00%	80.93%	8.30%	3.17%	1.07%	0.18%
BB	0.03%	0.14%	0.67%	7.73%	80.53%	8.84%	1.00%	1.06%
B	0.00%	0.10%	0.26%	0.43%	6.48%	80.46%	7.07%	5.20%
CCC	0.22%	0.00%	0.22%	1.30%	2.38%	11.24%	64.86%	19.79%

Consider a bond initially rated "A".

(a) What is the probability that the bond rated "A" will be rated "BBB" at the end of the year? **(1 Mark)**

(b) For the A-rated bond in (a) above, you are provided with the following possible values in USD:

Year-end Rating	AAA	AA	A	BBB	BB	B	CCC	Default
Year-end Value	109.37	109.19	108.66	107.55	102.02	98.1	83.64	51.13

(i) Determine the expected value of the A-rated bond. **(2 Marks)**

(ii) Calculate the standard deviation of the A-rated bond. **(4 Marks)**

9. The following logistic regression output has been produced using credit data for a mobile-based loan issued by ASK Bank for the period 2014-2017. Use it to answer the questions that follow:

Dependent Variable: DEFAULT [EViews Output]
Method: ML - Binary Logit (Quadratic hill climbing)
Date: 06/13/18 Time: 12:08
Sample: 1 14910
Included observations: 14910
Convergence achieved after 10 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Estimate	Std. Error	z-Statistic	Prob.
AGE	β_1	-0.0189	0.003	-6.455	0.000
AMOUNT	β_2	-9.67E-08	1.97E-08	-4.904	0.000
GENDER	β_3	0.453	0.052	8.724	0.000
SECTOR	β_4	-0.047	0.005	-9.018	0.000
SECURED	β_5	-0.261	0.146	-1.789	0.074
TERM	β_6	-0.003	0.001	-4.034	0.000
Intercept (C)	β_0	-0.371	0.135	-2.742	0.006

McFadden R-squared	0.025	Mean dependent variable	0.172
S.D. dependent variable	0.376	S.E. of regression	0.372
Akaike info criterion	0.893	Sum squared residual	2063.635
Schwarz criterion	0.896	Log likelihood	-6647.196
Hannan-Quinn criterion.	0.894	Deviance	13294.390
Restr. deviance	13630.300	Restr. log likelihood	-6815.151
LR statistic (likelihood ratio)	335.910	Avg. log likelihood	-0.446
Prob(LR statistic)	0.000		

Obs with Dep=0	12364	Total observations	14910
Obs with Dep=1	2546		

Key to the variables

Variable	Definition	Attribute	Scores (for credit rating purposes)
Cutoff			790
DEFAULT	Dependent variable for default defined as $DEFAULT = \begin{cases} 1, default \\ 0, no\ default \end{cases}$	Default = 1 No default = 0	NA
AGE	Age of the borrower in years.	Age 18-29	-5
		Age 30-47	5
		Age 48+	2
AMOUNT	The amount of the loan taken in Kenya Shillings. Assume 1USD = 100 Kes.	< Kes 500,000	-2
		Kes 500,001-900,000	2
		Kes 900,001 – 1,500,000	5
		>Kes. 1,500,000	10
GENDER	Gender of the borrower, where 1 = male and 0 = female.	Male = 1	2
		Female = 0	5
SECTOR	The various sector represented by the borrowers, up to a total of 17 diverse industry/service sectors.	Each of the 17 sectors has an equal weight	2
SECURED	Whether the loan is secured or not.	Secured = 1	5
		Not secured = 0	-5
TERM	The term of the loan, in months.	<56 months	2
		57-67 months	-2
		68-72 months	-3
		>72 months	-4

(i) Interpret the association of each variable according to direction of association and statistical significance using a significance level of 1%. **(4 Marks)**

(ii) How reliable is the credit scoring model? **(2 Marks)**

(iii) Assuming the following risk grades for the Experian generic credit score:

Score	Creditworthiness assessment
0-560	Very poor
561-720	Poor
721-880	Fair
881-960	Good
961-999	Excellent

Determine whether borrowers with the following characteristics will be granted the loan. **(3 Marks)**

Borrower	Characteristics
P	A male applicant, aged 35, has applied for an unsecured facility of Kes. 600,000 for 60 months.
Q	A female applicant, aged 28, has applied for secured facility of Kes. 120,000 for 20 months.

ANSWER ANY TWO OF THE FOLLOWING QUESTIONS.

Question 2 (20 Marks)

Part A: (10 Marks)

John Pentanol was appointed as risk manager at H&Z Company a year ago and he decided that his first task was to examine the risks that faced the company. He concluded that the company faced three major risks, which he assessed by examining the impact that would occur if the risk were to materialise. He assessed Risk 1 as being of low potential impact as even if it materialised it would have little effect on the company's strategy. Risk 2 was assessed as being of medium potential impact whilst a third risk, Risk 3, was assessed as being of very high potential impact.

When John realised the potential impact of Risk 3 materialising, he issued urgent advice to the board to withdraw from the activity that gave rise to Risk 3 being incurred. In the advice he said that the impact of Risk 3 was potentially enormous and it would be irresponsible for H&Z to continue to bear that risk.

The company commercial director, Jane Xylene, said that John Pentanol and his job at H&Z were unnecessary and that risk management was "very expensive for the benefits achieved". She said that all risk managers do is to tell people what can't be done and that they

are pessimists by nature. She said she wanted to see entrepreneurial risk takers in H&Z and not risk managers who, she believed, tended to discourage enterprise.

John replied that it was his job to eliminate all of the highest risks at H&Z Company. He said that all risk was bad and needed to be eliminated if possible. If it couldn't be eliminated, he said that it should be minimized.

The risk manager has an important role to play in an organization's risk management.

a) Describe the roles of a risk manager. **(5 Marks)**

b) Assess John Pentanol's understanding of his role. **(5 Marks)**

Part B: (10 Marks).

1. What is the primary responsibility of a Capital markets regulator of any jurisdiction?

   A. Regulating the securities industry, stocks, and options exchanges.

   B. Enforcing the federal securities laws.

   C. Regulating electronic securities markets.

   D. All of the above.

2. Small and illiquid assets that are unable to be sold individually can be pooled together into financial instruments in order to reduce risk and to be sold to general investors. This strategy is called:

   A. Diversification.

   B. Securitization.

   C. Investment.

   D. Due diligence.

3. You want to borrow money from a bank and your house is used as a mortgage, which serves as a protection for the bank in case you default on your repayment. In a mortgage loan, the house represents what of the following?

   A. A debt.

   B. Collateral.

   C. An interest from lending the money.

   D. A credit risk.

4. Suppose two bonds are trading in the secondary market. They have the same maturity date and similar credit quality, but one has a nominal yield of 4% while the other has one of 8%. What does this really tell you about the two bonds?

   A. One is more attractive than the other.

   B. Two bonds must be different in values.

   C. Two bonds must have been issued by different lenders.

   D. Two bonds must have been issued at different times.

5. Tom is thinking to buy bonds. However, he is debating between long-term bonds and short-term bonds. What factors will influence his decision?

   A. His available funds.

   B. His risk preferences.

   C. The relative yields between short-term and long-term bonds.

   D. His personal patience level.

6. The Dutch tulip bulb crisis (AKA "Tulipmania") in February 1637, happened as the contract prices for Tulip bulbs soared from November 1636 to January 1637 and suddenly collapsed in February 1637. What does the case illustrate?

   A. Frenzy optimism about the growth in Tulip bulb prices.

   B. A speculative bubble.

   C. Irrational investing.

   D. A confidence crisis.

7. What are the four options for dealing with a risk?

   A. Accept, mitigate, transfer, and avoid.

   B. Accept, insure, transfer, and avoid.

   C. Accept, mitigate, reduce, and avoid.

   D. Situation, task, action, and result.

   E. It's a trick question-there are only three and they are transfer, mitigate, and avoid.

8. According to the CAPM model: Expected Return = Risk free rate + Risk premium. For investors like David, the model compensates the time value of his money and risk when he invests into any investment over a period of time. What does the risk free rate compensate David for?

   A. The time value of his money.

   B. The risk he takes.

   C. Both the time value of his money and the risk he takes.

   D. None

9. What is true about the risk free rate?

   A. The risk free rate represents the interest an investor would expect from an absolutely risk free investment over a specified period of time.

   B. The risk free rate is the minimum return that an investor expects for any investment. A rational investor will not accept any additional risk unless the potential rate of return is greater than the risk free rate.

   C. The risk-free rate does not truly exist because even the safest investments carry a very small amount of risk.

D. All of the above.

10. Beta provides a measure of the "systematic risk" of the portfolio. This is the part of the risk that cannot be diversified away. Given that the portfolio risk is measured by its covariance, why are investors still willing to hold assets with lower expected returns?

    A. Assets with low expected returns now can yield higher returns in the future.

    B. Investors do not have any other better alternatives.

    C. Although these assets have low expected returns, they are less risky due to low overall systematic risk.

    D. Low expected returns attract less investors, so it is difficult to sell them.

Question 3 (20 Marks)

Part A: (10 marks)

(a) Define value at risk (VaR) and highlight its application in risk management. **(5 Marks)**

(b) A futures contract is currently priced at USD 220. The initial margin requirement is USD 10, and the maintenance margin requirement is USD 8. A dealer takes up 20 contracts.

Complete the following table given the changes in the futures price assuming that the dealer is long. **(5 Marks)**

Day	Balance b/f	Funds deposited	Futures price (USD)	Price change	Gain/loss	Balance c/f
0			220			
1			218			
2			216			
3			216			
4			218			
5			219			

Part B: (10 Marks).

1. Which of the following statements most accurately describes a derivative security?
   A: always increases risk
   B: has no expiration date
   C: has a payoff based on an asset value or interest rate
2. Which of the following derivatives is a forward commitment?
   A: Stock option
   B: Interest rate swap
   C: Credit default swap
3. A custom agreement to purchase a specific T-bond next Thursday for USD 1,000 is:
   A: an option
   B: a futures contract
   C: a forward commitment

4. Interest rate swaps are:
   A: highly regulated
   B: equivalent to a series of forward contracts
   C: contracts to exchange one asset for another
5. The difference between a fixed-for-floating swap ad an equivalent series of forward contracts is that:
   A: the payment dates would be unlikely to match
   B: all the fixed-rate payments in a swap are equal
   C: the floating-rate payments in a swap are unknown
6. At expiration, the exercise value of a put option:
   A: is positive if the underlying asset price is less than the exercise price
   B: is zero only if the underlying asset price is equal to the exercise price
   C: is negative if the underlying asset price is greater than the exercise price
7. The underlying asset of a derivative is most likely to have a convenience yield when the asset:
   A: is difficult to sell short
   B: pays interest or dividends
   C: must be stored and insured
8. A call option is:
   A: the right to sell at a specific price
   B: the right to buy at a specific price
   C: an obligation to buy at a certain price
9. Derivative pricing models use the risk-free rate to discount future cashflows because these models:
   A: are based on portfolios with certain payoffs
   B: assume that derivatives investors are risk neutral
   C: assume that risk can be eliminated by diversification
10. Which of the following statements is correct when comparing the differences between an interest rate swap and a currency swap?
    A: At maturity, there is no exchange of principal between the counterparties in interest rate swaps and there is an exchange of principle in currency swap transactions.
    B: At maturity, there is no exchange of principal between the counterparties in currency swaps and there is an exchange of principle in interest rate swap transactions.
    C: The counterparties in a interest rate swap need to consider fluctuations in exchange rates, while currency swap counterparties are only exposed to fluctuations in interest rates.
    D: Currency swap counterparties are exposed to less counterparty credit risk due to the offsetting effect of currency risk and interest rate risk embedded within the transaction.

Question 4 (20 Marks)

Your firm has recently been approached by Ferry Co to carry out a business risk analysis. Three and a half years ago, Ferry purchased exclusive rights to operate a car and passenger ferry route for nine years. This offers an alternative to driving an additional 150 kilometres via the nearest bridge crossing. There have been several ambitious plans to build another crossing but they have failed through lack of public support and government funds.

Ferry refurbished two 20-year-old roll on, roll off ("Ro-Ro") boats to service the route. The boats do not yet meet the emission standards of Environmental Protection Regulations which come into force in 18 months' time. Each boat makes three return crossings every day of the year, subject to weather conditions, and has the capacity to carry approximately 250 passengers and 40 vehicles. The ferry service carried just 70,000 vehicles over the last 12 months (prior year: 58,000 and 47,000 two years ago). Hot and cold refreshments and travel booking facilities are offered on the one hour crossing. These services are provided by independent businesses on a franchise basis.

Ferry currently receives a subsidy from the local transport authority as an incentive to increase market awareness of the ferry service and its efficient and timely operation. The subsidy increases as the number of vehicles carried increases and is based on quarterly returns submitted to the authority. Ferry employs 20 full-time crew members who are trained in daily operations and customer-service, as well as passenger safety in the event of personal accident, collision or breakdown.

The management of Ferry is planning to apply for a recognised Safety Management Certificate (SMC) in 12 months' time. This will require a ship audit including the review of safety documents and evidence that activities are performed in accordance with documented procedures. A SMC valid for five years will be issued if no major non-conformities have been found.

(a) Identify and explain the business risks facing Ferry Co which should be assessed.

(10 Marks)

(b) Describe the processes by which the risks identified in (a) could be managed and maintained at an acceptable level by Ferry Co**.** **(10 Marks)**

FORMULAE SHEET

Macaulay bond duration:

$$MD = \frac{1}{P}\sum_{n=1}^{n}\frac{iC_i}{(1+y)^i} + n\frac{nM}{(1+y)^n}$$

$$\text{Modified Duration} = \frac{\text{Macaulay Duration}}{1 + \frac{\text{Yield to maturity}}{\text{Number of coupon periods per year}}}$$

Yield to maturity

$$Approx\,YTM = \frac{C + \frac{F-P}{n}}{\frac{F+P}{2}}$$

$C = Coupon/Interest\ Payment$
$F = Face\ Value$
$P = Price$
$n = years\ to\ maturity$

Sharpe ratio

$$\frac{R_p - R_f}{\sigma_p}$$

Where:
R_p = Portfolio Return
R_f = Risk-Free Rate (3-month Treasury Rate is standard)
σ_p = Portfolio Risk, aka Standard Deviation of Returns

Jensen's alpha

$$Jensen = \alpha_P = R_P - \left[R_f + \beta_P\left(R_M - R_f\right)\right]$$

Treynor's ratio

$$T = \frac{r_i - r_f}{\beta_i}$$

where: $T \equiv$ Treynor ratio,

$r_i \equiv$ Portfolio's return, $r_f \equiv$ risk free rate $\beta_i \equiv$ portfolio i's beta

CAPM formula

$\bar{r}_a = r_f + \beta_a(\bar{r}_m - r_f)$

Where:
r_f = Risk free rate
β_a = Beta of the security
$\bar{r}_m$ = Expected market return

Black scholes option pricing formula

$$C = SN(d_1) - N(d_2)Ke^{-rt}$$

$$d_1 = \frac{\ln\left(S/K\right) + \left(r + s^2/2\right)t}{s\cdot\sqrt{t}}$$

$$d_2 = d_1 - s\cdot\sqrt{t}$$

C = Call premium
S = Current stock price
t = Time until option exercise
K = Option striking price
r = Risk-free interest rate
N = Cumulative standard normal distribution
e = Exponential term

s = St. Deviation
ln = Natural Log

Expected loss (EL)

$$Total\ EL = \sum_{i}^{n} PD_i * LGD_i * EAD_i$$

Exposure at default (EAD), loss given default (LGD) and probability of default (PD)

$$C - P = S - K/(1+r)^T$$

Where:
- C = Call option price today
- S = Stock price today
- r = Risk-free interest rate
- P = Put option price today
- K = Strike price of the put and the call
- T = Time remaining until option expiration in years