Tutorial Letter 201/1/2017

Investments: Derivatives

INV3703

Semesters 1

Department of Finance, Risk management and Banking

IMPORTANT INFORMATION

Please register on myUnisa, activate your myLife e-mail addresses and make sure that you have regular access to the myUnisa module website, INV3703-2017-S1/S2, as well as your group website.

Note: This is an online module and therefore it is available on myUnisa. However, in order to support you in your learning process, you will also receive some study material in printed format.

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CONTENTS

Page

1 INTRODUCTION

The purpose of this tutorial letter is to provide you with suggested answers to Assignment 01 and Assignment 02, and to give you guidelines for the examination.

Regarding the assignments, the total marks of the assignments differed in each case. The following table indicates the marks per assignment and the weight that each contributes to your year mark.

Assignment	Total marks	Weight
01	20	50%
02	24	50%

To calculate your year mark and final mark, use the following example:
A1 – Percentage for assignment 01: 80%
A2 – Percentage for assignment 02: 61%
E1 – Percentage for examination: 50%

Final mark = {[(A1 x weight$_{01}$) + (A2 x weight$_{02}$)] x 0.2} + {(E1 x weight$_{Exam}$) x 0.8}
Final mark = {[(80 x 0.5) + (61 x 0.5)] x 0.2} + {(50 x 1.0) x 0.8}
Final mark = {[(40) + (30.5)] x 0.2} + {(50) x 0.8}
Final mark = {[70.5] x 0.2} + {(50) x 0.8}
Final mark = {14.1} + {40}
Final mark = 54.1 rounded to 54%

2 SUGGESTED ANSWERS TO ASSIGNMENT 01

PART 1

Assume that you own a share that pays dividends during the year. The share currently trades at $47.00. You wish to hold the share for only 220 days. With current market conditions you believe you should hedge against a possible decline in price of the share by entering into a short forward contract that expires in 220 days. The continuously compounded return on the Government bond is 6.766%.

You expect the following dividends from the share:

Number of days before next dividend	Dividend per share
30	$1.00
120	$2.00
210	$4.00

The discrete interest rate of the Government bond is closest to ____ %
$r = e^{r} - 1$
$r = e^{0.6766} - 1$
$r = 0.07$ and is **7%**

The present value (PV) of the remaining dividends is closest to $____
(Make use of the discrete interest rate. Round to 4 decimals i.e. 0.1234)

$$PV(D) = \sum_{K=1}^{3} \frac{D_K}{(1+r)^{T_K}}$$

$$PV(D) = \frac{\$1.00}{(1.07)^{0.0822}} + \frac{\$2.00}{(1.07)^{0.3287}} + \frac{\$4.00}{(1.07)^{0.5753}}$$

$$PV(D) = 6.7978$$

The forward price of a contract, which you entered into today that expires in 220 days is closest to $____

$$F_{0,T} = [S_0 - PV(D)]\,(1+r)^T$$

$$F_{0,T} = [47 - 6.7978]\,(1+0.07)^{0.6027}$$

$$F_{0,T} = \$41.88$$

If the share is worth $40.00 at expiration, the value of the contract at expiration is closest to $____

$$V_{0,T} = S_T - F_{0,T}$$

$$V_{0,T} = 40 - 41.87$$

$$V_{0,T} = -1.87$$

Because you were transacting from a short position, the answer is $1.87.

PART 2

Consider a futures contract that is currently priced at $155.65. The initial margin requirement is $20 and the maintenance margin requirement is $15. You are long 15 contracts and meet all margin calls without ever withdrawing any excess funds. Use the table below to assist you in your calculations and answering the questions.

Day	Beginning balance	Funds deposited	Futures price	Price change	Gain/Loss	Ending balance
0		$300.00	$155.65			$300.00
1	$300.00	$0.00	$157.01	$1.36	$20.40	$320.40
2	$320.40	$0.00	$160.52	$3.51	$52.65	$373.05
3	$373.05	$0.00	$161.22	$0.70	$10.50	$383.55
4	$383.55	$0.00	$156.05	-$5.17	-$77.55	$306.00

The amount that was initially deposited is closest to $____
$300

The change in price of the futures contract on day 1 was closest to $____
$1.36

The Gain/Loss on day 2 was closest to $____
$52.65

The ending balance on day 4 was closest to $____
$306.00

PART 3

Hugo believes that the South African Reserve Bank (SARB) may decrease short term interest rates to stimulate the South African economy. Hugo manages risk at a financial institution and he decides to go short on an FRA that expires in 90 days. The FRA is based on the 90-day LIBOR rate and the current LIBOR rates are as follow:

Which one of the following best describes the FRA used by Hugo?

- A. 1 x 3 FRA
- B. 3 x 6 FRA
- C. 6 x 12 FRA
- D. 6 x 9 FRA
- E. 3 x 3 FRA

From the given information, allocate the correct values to the following variables.
m = 90 days
$L_0(h + m) = 6.44\%$

The FRA rate (in decimal form) is closest to ____
*Please round to four decimal places.

$$FRA_{0,h,m} = \left[\frac{1 + L_0(h+m)\left(\frac{h+m}{360}\right)}{1 + L_0(h)\left(\frac{h}{360}\right)} - 1\right]\left(\frac{360}{m}\right)$$

$$FRA_{0,h,m} = \left[\frac{1 + 0.0644\left(\frac{180}{360}\right)}{1 + 0.0627\left(\frac{90}{360}\right)} - 1\right]\left(\frac{360}{90}\right)$$

$$FRA_{0,h,m} = [0.0163](4)$$

$$FRA_{0,h,m} = \text{ 0.0651 or 6.51\%}$$

As Hugo anticipated, the interest rates have shifted. 30-days after he took a short position in the FRA the term structure for LIBOR changed as follow:

Term	Interest Rate
60-day	5.93%
150-day	6.01%

Due to the changes in the interest rate, the new value of the FRA (in decimal form) is closest to ____
*Round to four decimal places.

$$V_g(0,h,m) = \frac{1}{1 + L_g(h-g)\left(\frac{h-g}{360}\right)} - \frac{1 + FRA(0,h,m)\left(\frac{m}{360}\right)}{1 + L_g(h+m-g)\left(\frac{h+m-g}{360}\right)}$$

$$V_g(0,h,m) = \frac{1}{1 + 0.0593\left(\frac{60}{360}\right)} - \frac{1 + 0.065\left(\frac{90}{360}\right)}{1 + 0.0601\left(\frac{150}{360}\right)}$$

$$V_g(0,h,m) = \text{ 0.9902 } - \text{ 0.9915}$$

$$V_g(0,h,m) = \text{ –0.0013}$$

PART 4

A country domiciled in the USA wishes to engage in a transaction with a company that operates from the EU. The Euro spot exchange rate is $1.124. The discrete USA interest rate is 3% and the discrete EU interest rate is 2%. A futures contract expires in 126 days.

The length of the futures contract (T) in decimal form is:

$$T = \frac{Actual}{365}$$
$$T = \frac{126}{365}$$
$$T = 0.3452$$

The continuously compounded interest rate for the EU and the USA are calculated as:

USA

$$r = Ln(1 + r)$$
$$r = Ln(1 + 0.03)$$
$$r = 0.0296$$

EU

$$r = Ln(1 + r)$$
$$r = Ln(1 + 0.02)$$
$$r = 0.0198$$

The appropriate futures price using the continuous interest rates is closest to $____

$$F(0,T) = \left(S_0 e^{-r^{fc}T}\right) e^{r^{c}T}$$
$$F(0,T) = (\$1.124 e^{-0.0198 \times 0.3452}) e^{0.0296 \times 0.3452}$$
$$F(0,T) = \$1.1278$$

3 SUGGESTED ANSWERS TO ASSIGNMENT 02

PART 1

Consider a European style put option on a bond. The option expires in 87 days. The bond is currently priced at $62.00 and makes no cash payments during the life of the option. The risk-free rate is 9% and the put option has an exercise price of $72.00.

The highest possible price for this put option is closest to $____

$$X(1 + r)^{-t} - S_0 \leq p \leq X(1 + r)^{-t}$$
$$72(1 + 0.09)^{-(\frac{87}{365})} - 62 \leq p \leq 72(1 + 0.09)^{-(\frac{87}{365})}$$
$$72(1.09)^{-0.2384} - 62 \leq p \leq 72(1.09)^{-0.2384}$$
$$8.54 \leq p \leq 70.54$$

Upper bound = $70.54

The lowest possible price for this put option is closest to $____

$$X(1 + r)^{-t} - S_0 \leq p \leq X(1 + r)^{-t}$$
$$72(1 + 0.09)^{-(\frac{87}{365})} - 62 \leq p \leq 72(1 + 0.09)^{-(\frac{87}{365})}$$
$$72(1.09)^{-0.2384} - 62 \leq p \leq 72(1.09)^{-0.2384}$$
$$8.54 \leq p \leq 70.54$$

Lower bound = $8.54

PART 2

An analyst at Selah Capital is provided with the following information on put and call options on a stock.

Call price	$2.75
Put price	$2.03
Strike price	$20
Days to option expiration	198
Current stock price	$25
Risk-free rate	4%

By using put-call parity the price of the synthetic call option is closest to $____
Synthetic call:

$c = S + p - X(1 + r)^{-t}$

$c = 25 + 2.03 - 20(1 + 0.04)^{-(\frac{198}{365})}$

$c = 7.45$

By using put-call parity the price of the synthetic share is closest to $____
Synthetic share

$S = c + X(1 + r)^{-t} - p$

$S = 2.75 + 20(1 + 0.04)^{-(\frac{198}{365})} - 2.03$

$S = 20.30$

PART 3

Consider a one-period binomial model in which a stock currently trades at a price of $35. The stock price can go up 26% or down 11% each period. The risk-free rate is 9%. A European put option expiring in one period has an exercise price of $23.

The probability of an upward move for the one-period binomial model is closest to ____
Probability:

$$\pi = \frac{(1 + r) - d}{u - d}$$

$$\pi = \frac{(1 + 0.09) - 0.89}{1.26 - 0.89}$$

$\pi = 0.5405$

PART 4

Consider an asset that trades at $41 today. Call and put options on this asset are available at an exercise price of $43. The options expire in 71 days, and the volatility is 0.41. The continuously compounded risk-free rate is 5.3%.

Use the Black-Scholes model to calculate d_1. The value of d_1 is closest to ____

$$d_1 = \frac{\ln(S/X) + [r^c + (\sigma^2/2)]T}{\sigma\sqrt{T}}$$

$$d_1 = \frac{\ln(41/43) + [0.053 + (0.41^2/2)]\,71/365}{0.41\sqrt{71/365}}$$

$d_1 = -0.12$

Use the Black-Scholes model to calculate the value of $N(d_2)$. $N(d_2)$ is exactly ____
*Use the exact value as from the normal probability distribution table.

$d_2 = d_1 - \sigma\sqrt{T}$

$d_2 = -0.12 - 0.41\sqrt{{}^{71}/_{365}}$

$d_2 = -0.30$

$N(d_2) = 0.3821$

Use the Black-Scholes model to calculate the value of a European call option, the value of an European call option would be closest to $____

$c = SN(d_1) - Xe^{-r^cT}N(d_2)$

$c = (41 \times 0.4522) - \left(43e^{[-0.053\times(71/365)]} \times 0.3821\right)$

$c = \$2.28$

PART 5

Consider a two period binomial model in which the stock currently trades at $80. The stock price can go up 20 percent or down 20 percent each period. The risk-free rate is 10 percent. A put option on this stock expiring in two periods has an exercise price of $90.

Suppose you bought 10 000 puts, the approximate number of units of the underlying stock that would be needed at time 0 in the binomial tree in order to construct a risk-free hedge would be closest to ____ shares.

Probability:

$\pi = \dfrac{(1+r)-d}{u-d}$

$\pi = \dfrac{(1+0.1)-0.8}{1.2-0.8}$

$\pi = 0.75$

$1 - \pi = 1 - 0.75$

$1 - \pi = 0.25$

p^+ = $3.00

p^- = $17.82

$n = {}^{(p^- - p^+)}/_{(S^+ - S^-)}$

$n = {}^{(17.82 - 3)}/_{(96 - 64)}$

$n = 0.4631$

To hedge this position, would you be long or short in this position in the shares?

- (•) A. Long
- ( ) B. Short
- ( ) C. Neutral

Long position in 4631 shares of the underlying stock.

PART 6

Richard is a swap dealer who is considering taking a position in a one-year swap with quarterly payments. Assume a notional principal of $4 million. The annualised LIBOR spot rates are:

$L_0(90) = 0.0688$
$L_0(180) = 0.0691$
$L_0(270) = 0.0725$
$L_0(360) = 0.0755$

If Richard is a fixed rate payer, the quarterly payment on the $4 million notional principal would be closest to $____

*Use at least four decimal places in all your calculations.

$$B_0(90) = \frac{1}{1 + \left(0.0688 \times {}^{90}/_{360}\right)}$$
$$B_0(90) = 0.9831$$

$$B_0(180) = \frac{1}{1 + \left(0.0691 \times {}^{180}/_{360}\right)}$$
$$B_0(90) = 0.9666$$

$$B_0(270) = \frac{1}{1 + \left(0.0725 \times {}^{270}/_{360}\right)}$$
$$B_0(270) = 0.9484$$

$$B_0(360) = \frac{1}{1 + \left(0.0755 \times {}^{360}/_{360}\right)}$$
$$B_0(360) = 0.9298$$

$$C = \left(\frac{1 - Z_4}{Z_1 + Z_2 + Z_3 + Z_4}\right)$$
$$C = \left(\frac{1 - 0.9831}{0.9831 + 0.9666 + 0.9484 + 0.9298}\right)$$
$$C = 0.0183$$

$$Quarterly\ fixed\ payment = NP \times C$$
$$Quarterly\ fixed\ payment = 4000000 \times 0.183$$
$$Quarterly\ fixed\ payment = \$73\ 300.00$$

At day 55 the new term structure of LIBORs are as follows:

$L_{55}(35) = 0.0810$
$L_{55}(125) = 0.0835$
$L_{55}(215) = 0.0888$
$L_{55}(305) = 0.0921$

The market value of the swap 55 days later from the point of view of Richard i.e. paying the fixed rate and receiving the floating rate, is closest to $____
*Use at least four decimal places in all your calculations.

$$B_{55}(35) = \frac{1}{1 + \left(0.0810 \times {}^{35}/_{360}\right)}$$
$$B_{55}(35) = 0.9922$$

$$B_{55}(125) = \frac{1}{1 + \left(0.0835 \times {}^{125}/_{360}\right)}$$
$$B_{55}(125) = 0.9718$$

$$B_{55}(215) = \frac{1}{1 + \left(0.0888 \times {}^{215}/_{360}\right)}$$
$$B_{55}(215) = 0.9496$$

$$B_{55}(305) = \frac{1}{1 + \left(0.0921 \times {}^{305}/_{360}\right)}$$
$$B_{55}(305) = 0.9298$$

Present value of remaining fixed payments
$$= 0.0183 \times (0.9922 + 0.9718 + 0.9496 + 0.9298) + 1(0.9298)$$
$$= 0.9980$$

Present value of remaining floating payments
$$= (0.0688 \times {}^{90}/_{360} + 1)(0.9922)$$
$$= 1.0093$$

Market value (pay-fixed, receive floating)
$$= \$4\,000\,000 \times (1.0093 - 0.9980)$$
$$= \$45\,200$$

PART 7

Chris is an asset manager at ABC Capital who wishes to reduce his exposure to equities and increases his exposure to fixed-income securities. He agrees to pay a dealer the return on a large-cap index, and the dealer agrees to pay Chris a fixed rate of 3 percent. The value of the large-cap index starts off at 1696.44 and six months later is at 1723.42. Assume that the payments are made semi-annually. The notional principal is $34 million.

The holding-period return of the large cap index is closest to ____%
*Use at least four decimal places in all your calculations.

$$Index\ return = \frac{Large\ cap\ return\ (end)}{Large\ cap\ return\ (begin)} - 1$$
$$Index\ return = \frac{1723.42}{1696.44} - 1$$
$$Index\ return = 0.0159$$
1.59% return

The overall payment six months later is closest to $____
*Use at least four decimal places in all your calculations.

$$Return\ on\ index\ = 0.0159 \times 34000000$$
$$Return\ on\ index\ = \$540\ 600.00$$

$$Fixed\ payment\ = 0.03 \times {}^{180}/_{360} \times 34000000$$
$$Fixed\ payment = \$510\ 000.00$$

Who makes the payment in this swap?

- A. The asset manager pays the dealer.
- B. The dealer pays the asset manager.

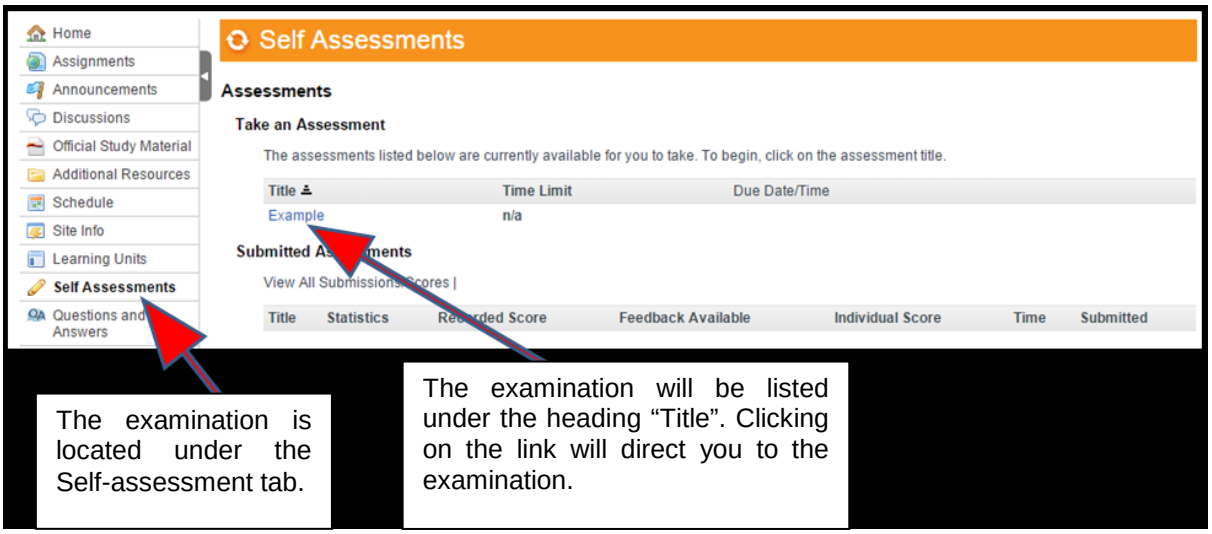
Asset manager pays dealer $30 600.00 ($540600 – $510000), the fixed payment was lower than the return on the index.

4 EXAMINATION INFORMATION

As all students are aware by now, the INV3703 exam will be conducted on myUnisa. The examination will not take place on only one day; it will run for a few days. **The examination will be released on 7 May 2017 at 05:00 (5am) and will run until 9 May 2017 at 23:59 (11:59pm) South African time.** Please note that no IT assistance will be available after official Unisa work hours.

You will have two-hours to complete the examination, and the examination will consist of approximately 30 questions that each contributes a different number of marks to the total marks of approximately 60 marks. You will be examined on Chapters 1 to 5 of the prescribed textbook. The specific learning outcomes of each of these chapters are available under the tab *Learning Units* on myUnisa. The examination will consist of a mix of questions, very similar to the questions of Assignment 01 and Assignment 02. You may also expect longer type written questions.

To access the examination you should log onto myUnisa and access the INV3703 module site. Thereafter, click on the *Self Assessments* tab, you will find the title of the assessment published under the heading, *Take an Assessment*. Please see the illustration on the next page.



Some questions that have been raised regarding the examination:

- Accidentally logged out?

You can easily access the examination again under the Self Assessment tab. Please note that the time will continue to run although you accidentally logged out.

- Load-shedding?

Eskom has published load-shedding schedules. Please plan to write the examination within a period that you will not have load-shedding. Should an unfortunate circumstance arise that might prevent you from completing the examination, you may contact the lecturer to request an additional assessment. These opportunities will not be granted automatically, but will be reviewed on a case-to-case basis.

- Formula sheets?

No formula sheet will be provided. The examination is essentially an open-book examination as you will be completing the examination at home, without any invigilation.

- Letters to employers?

We cannot provide individual letters to employers. Please inform your employer of the full details of the examination and how the examination will be conducted over the period stipulated.

- Mock exam?

There will not be a mock exam. Assignment 01 and assignment 02 were online assignments and the examination will be in a similar format.

- Feedback on questions?

Feedback is provided on Assignment 01 and on Assignment 02 in the Tutorial Letter 201, and will only be available online. For the examination there will however not be any feedback.

- Number of submissions?

You will have one submission attempt. If there is a timeout or interruption for any reason, ICT/IT will audit the user account and inform the lecturer whether an additional attempt may be granted. If there are, however, a number of separate incidents, the lecturer may grant an exemption to allow all students an additional attempt at the assessment or, if the assessment has been submitted, each student may decide whether an additional attempt is necessary.

- What counts as an attempt?

The system sees any access to the assessment as an attempt. Therefore, if you click on *Begin assessment*, it is counts as an attempt. Attempts are not only completed or submitted attempts. If you view the examination and close it, it counts as an attempt. On each attempt the system will automatically draw a new assessment from a database of questions.

- Write at home?

The examination can take place anywhere that you have uninterrupted access to myUnisa to complete the examination. Please do not go to an examination centre as there are no computers available. You can take the examination at home, in internet cafés, in public Wi-Fi areas, or at your office.

- Is it an open-book examination?

The examination is non-venue based and not invigilated. You can use the study material available to you as you complete your examination, but I do suggest that you get to know the work before you attempt the examination, as there is a time limit that applies to writing the examination.

- Cannot access the assessment?

The only reason you would not be able to access the assessment would be because you did not adhere to the due dates of the assessment. However, if you do struggle to complete the assessment, do not wait until after the due date before contacting the lecturer. The assessment is open for more than a week. I suggest you complete the assessment as early as possible. If you cannot access the assessment, contact the lecturer before the due date as no extensions will be allowed.

- Subminimum?

Yes, a subminimum does apply. You have to score at least 40% in the examination in order for your year mark to be considered. Thus if you fail the examination with a mark of 38%, your final mark will be 38%, even if your year mark was 100%.

- Sick exams and other issues?

Even though the location of the examination has been changed, the rules remain the same. If you cannot do the examination within the prescribed period, you should apply for an aegrotat or sick exam via the official university processes. Remember that if you are not sick for the entire allowed period of the examination, you will not be granted a sick examination. The same will apply for any other request that would qualify you for an aegrotat examination.

5 CONCLUDING REMARKS

As this is an online module, please make use of the interactive resources available on the INV3703 web pages on the myUnisa site. Please do not hesitate to contact me if you have any difficulty with this module, as I will gladly assist.

Kind regards
Mr CF Erasmus