WESTERN SYDNEY
UNIVERSITY

FINAL EXAM – AUTUMN/1H SESSION 2016

School of Business

Complete your details in this section when instructed by the Exam Supervisor at the start of the exam. *You should also complete your details on any answer booklets provided.*	
STUDENT SURNAME:	
STUDENT FIRST NAME:	
STUDENT ID:	

EXAM INSTRUCTIONS

Read all the information below and follow any instructions carefully before proceeding.
This exam is printed on <u>both sides</u> of the paper – ensure you answer all the questions.
You may begin writing when instructed by the Exam Supervisor at the start of the exam.
Clearly indicate which question you are answering on any Examination Answer Booklets used.

UNIT NAME:	Derivatives		
UNIT NUMBER:	200079		
NUMBER OF QUESTIONS:	Part A has 5 questions, Part B has 5 questions.		
VALUE OF QUESTIONS:	Exam questions are worth 50 marks in total.		
ANSWERING QUESTIONS:	Part A: Answer multiple choice questions on the scan sheet provided. Part B: Answer all other questions on the exam paper itself.		
LECTURER/UNIT COORDINATOR:	Keith Woodward and Maria Varua		
TIME ALLOWED:	2 hours	TOTAL PAGES:	15

RESOURCES ALLOWED

Only the resources listed below are allowed in this exam.

Any calculator which has the primary function of a calculator is allowed. For example, calculators on mobile phones or similar electronic devices are not allowed.

DO NOT TAKE THIS PAPER FROM THE EXAM ROOM

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Part A

Question 1: Which of the following derivative instruments has a non-zero value when it is first issued?

*(a) Call option.

(b) Futures contract.

(c) Forward contract.

(d) Forward rate agreement.

(e) Interest rate swap.

Question 2: Which of the following derivative instrument positions does **NOT** require a margin account?

(a) Long futures contract.

(b) Short futures contract.

*(c) Long call option.

(d) Short call option.

(e) Short put option

Question 3: Which of the following best describes a **long** position in an **American**-style **put** option?

(a) The right to buy the underlying asset for the exercise price at the option's exercise date.

(b) The right to sell the underlying asset for the exercise price at the option's exercise date.

(c) The right to buy the underlying asset for the exercise price at any time on or before the option's exercise date.

*(d) The right to sell the underlying asset for the exercise price at any time on or before the option's exercise date.

(e) The obligation to buy the underlying asset for the exercise price at the option's exercise date.

Question 4: Which of the following statements about fixed-for-floating interest rate swaps is **NOT** correct?

*(a) The principals are exchanged at the beginning and end of the swap.

(b) The fixed and floating payments throughout the life of the swap are netted.

(c) The fixed payments are called the 'fixed leg', and the floating payments are called the 'floating leg' of the swap.

(d) If the yield curve is normal, then at the beginning of a swap's life the fixed leg payments are expected to be greater than the floating leg payments.

(e) If the yield curve is normal, then at the end of a swap's life the floating leg payments are expected to be greater than the fixed leg payments.

Question 5: How is the value of a fixed-for-floating swap best calculated? Assume that the bonds mentioned below on which the swaps are based have $100 face values and have the same maturity as the swaps.

The value of a swap to the party paying the floating leg is equal to the swap's notional principal divided by $100, multiplied by, in brackets, the:

(a) Price of a fixed coupon bond plus the price of a floating rate bond.

*(b) Price of a fixed coupon bond less the price of a floating rate bond.

(c) Price of a fixed coupon bond multiplied by the price of a floating rate bond.

(d) Price of a fixed coupon bond divided by the price of a floating rate bond.

(e) Face value of a fixed coupon bond plus by the face value of a floating rate bond.

Part B

Question 1 (total of 8 marks): A stock index is expected to pay a continuously compounded dividend yield **4**% pa for the foreseeable future. The index is currently at **5,000** points and the continuously compounded total required return is **9**% p.a.. An investor has just taken a long position in an **8**-month futures contract on the index.

Question 1a (3 marks): Compute the futures price in index points.

*F8mth = S0*e^((r-q)*T)

= 5,000*exp((0.09-0.04)*8/12)

= 5169.475568

Question 1b (1 marks): Compute the initial value of the futures contract.

*V0 = 0

Question 1c (4 marks): Six months later the index has fallen to **4,900** points and the expected total required return and dividend yields are unchanged.

Compute the new value of the **long** position in the futures contract in index points. Note that the new value of the contract should be found, not the new futures price.

*First find the expected index price at t=8mth.

E(S8mth) = S6mth*exp((r-q)*2/12)

= 4,900*exp((0.09-0.04)*2/12)

= 4941.003946

Then find the current value of the long future which is the present value of St - Kt

V6mth,long = (E(S8mth) - K8mth)/exp(r*2/12)

= (4941.003946 - 5169.475568)/exp(0.09*2/12)

= -225.0701227 index points

Question 2 (8 marks): The below table summarises the borrowing costs confronting two companies.

Borrowing Costs		
	Fixed Rate	Floating Rate
Firm A	6%	6-month LIBOR + 2%
Firm B	6%	6-month LIBOR + 2.4%

Note that they can both borrow fixed at 6% pa, but the floating rates are different.

Suppose Firm A wants to borrow at a fixed rate and Firm B wishes to borrow floating.

Design an intermediated swap that provides a bank with a spread of **8** basis points p.a., and divides the remaining swap benefits **equally** between the two companies.

Use a clearly labelled diagram to summarise the terms of the arrangement.

*Neither firm has an absolute advantage in the fixed rate market, but firm A is better in the floating rate market. Therefore firm A has a comparative advantage in the floating rate market so it should issue a floating rate bond. Firm B has a comparative advantage in the fixed rate market so it should issue a fixed rate bond.

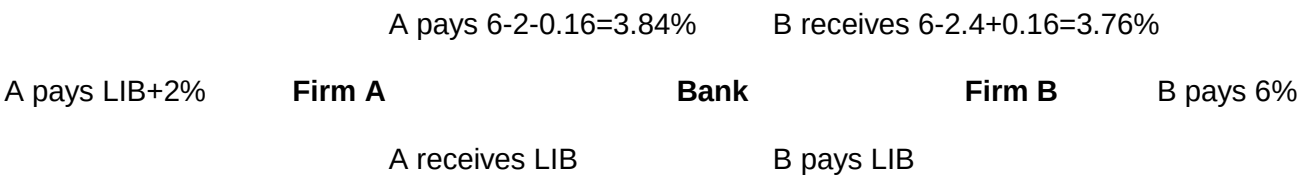
The total benefit available to all 3 parties including the bank is the absolute value of the difference of differences which is:

TotalBenefitToABAndBank = ||6-6| - |(2-2.4)|| = |0 - 0.4| = 0.4%

Subtract the bank's spread top find the benefit to the banks:

TotalBenefitToAandB = 0.4% - 0.08% = 0.32%

Firm A and B will share the benefits equally, so 0.16% (=0.32%/2) benefit each.



Question 3 (total of 8 marks): Consider the below screen shot of the details of an American call option on Commonwealth Bank (CBA).

CBAVC9 - $74.70 CALL OPTION EXPIRING 23/06/2016

Underlying Security Details: CWLTH BANK FPO [CBA] (ASX:CBA) As of: 15/04/2016 2:45:28 PM

Last Price	Today's Change	Bid	Offer	Day High	Day Low	Volume
$74.570	-$0.140 (-.19%)	$74.530	$74.570	$75.020	$73.760	1,573,151

Today's Last Price	**2.65**	**Bid**	2.820	**Theo Price**	3.139
Today's Change	**-0.41 (-13.40%)**	**Offer**	2.980	**Days To Expiry**	70
Open	2.65	**Previous Close**	0	**Shares per Contract**	100
Volume	7	**Open Interest**	562	**Today's Range**	2.65 - 2.65

As at 15/04/2016 2:45:29 PM

Buyers			Sellers	
Quantity	Price	#	Price	Quantity
250	2.820	1	2.980	250
100	2.815	2	2.990	100
100	2.775	3	3.000	100
100	2.660	4	3.130	100
100	2.615	5	3.215	100

Question 3a (1 marks): What is the bid-ask spread on these options?

*$0.16 (=2.98 – 2.82)

Question 3b (1 marks): What is your best estimate of the 'true price' of these call options?

*$2.90 (=(2.98 + 2.82)/2)

Question 3c (1 marks): What is the best price that you could **buy** one call option contract when placing a market order? Be aware that one call option contract is on 100 shares and prices are listed on a per-share basis rather than a per contract basis.

*$2.98 on a per share basis or $298 since one call option contract is on 100 shares.

Question 3d (1 marks): How much money could you **sell** 200 call options for? (Note that in this question you are selling, in the previous question, you are buying).

*$56,400 (=(200*$2.82)*100)

Question 3e (1 marks): What would be the **implicit cost** of **selling** these 200 call options, given your 'true price' answered above?

$1,600 (=(200(2.82 – 2.90))*100)

Question 3f (1 marks): Is this call option 'in-the-money' or 'out-of-the-money'?

*Out of the money.

Question 3g (1 marks): Why is the open interest larger than the daily volume?

*The open interest is the sum of all the daily volumes less the number of contracts closed out since the option was first offered by the exchange. The open interest is bigger than today's daily volume because there must have been contracts traded in the days before today that have not been closed out yet, adding to the current open interest in addition to today's volume.

Question 3h (1 marks): If the CBA stock price were to suddenly fall, would you expect the call option price to rise, fall, or stay the same?

***Fall**

Question 4 (total of 8 marks): Consider a **6** month European **call** option with a strike price of $5, written on a dividend paying stock currently trading at $5.50. The dividend is paid annually and the next dividend is expected to be $0.30, paid in 3 months. The risk-free interest rate is **5**% p.a. continuously compounded and the standard deviation of the stock's returns is 40% p.a..

Question 4a (3 marks): Calculate d_1.

*d1= 0.371008752

Question 4b (1 mark): Calculate d_2.

*d2= 0.08816604

Question 4c (1 mark): Calculate $N(d_1)$ using the tables in the back of this exam paper.

*N(d1)= 0.644684494

Question 4d (1 mark): Calculate $N(d_2)$ using the tables in the back of this exam paper.

*N(d2)= 0.535127646

Question 4e (2 marks): Calculate the call option price.

*c0= 0.745185401

Question 5 (total of 8 marks): Suppose a stock currently trades at $**100**. The stock's semi-annual dividend is expected to be $**6**, paid in 3 months from now. A 6-month European call option with a strike price of $**95** has a premium of $**9.83**. Assume a **10**% continuously compounded risk-free rate.

Question 5a (3 marks): Calculate the price of 6-month European put option with a strike price of $95 on this stock, as implied by the above information.

C0 + K/e^(r.T) = P0 + S0 - D0

9.83 + 95/exp(0.1*6/12) = P0 + 100 - 6/exp(0.1*3/12)

P0 = 9.83 + 95/exp(0.1*6/12) - (100 - 6/exp(0.1*3/12))

= 6.0486548

= 6.05 to the nearest cent.

Question 5b (5 marks): If the call option price mentioned above suddenly rose to $**11** but all else was unchanged and there was no news about the company, then explain how you could conduct a risk-free arbitrage. Assume that the call option is mis-priced. You're best able to show the steps using an arbitrage table.

*Short the physical call since it's overpriced. Long the synthetic call (=long put, long stock and short bond) to balance out the risk.

Viewing the below amounts as cash flows at time zero, then all positive cash flows are receipts to us now which are sell (short) transactions and all negative cash flows are payments from us now which are buy (long) transactions:

$$c_0 + K.e^{-r.T} = p_0 + (S_0 - D_0)$$

$$c_0 = p_0 + (S_0 - D_0) - K.e^{-r.T}$$

$$-c_0 = -p_0 - (S_0 - D_0) + K.e^{-r.T}$$

LongSyntheticCall = LongPut + LongStock + ShortBond

To find the amounts of these assets that we need to long and short to make a risk free zero capital arbitrage, we'll use an arbitrage table:

Action	t=0	t=3mth	t=6mth, ST>K	t=6mth, ST<K
Short physical call	11		-(ST-95)	0
Long put	-6.05		0	95-ST
Long stock	-100	6	ST	ST
Short bond to cover dividend (borrow now)	5.8519 (=6/exp(3/12*0.1)) (Step 4)	-6 (Step 3)		
Short bond (borrow now)	90.3668 (=95/exp(6/12*0.1)) (Step 5)		-95 (Step 2)	-95 (Step 2)
Total	1.1687 (Step 6)	0 (Step 1)	0 (Step 1)	0 (Step 1)

Formulas

$$r_{\text{continuously compounded}} = \ln(1 + r_{\text{discrete}})$$

$$P_0 = \frac{P_t}{e^{t.r_{\text{continuously compounded}}}}$$

$$P_0 = \frac{P_t}{(1 + r_{\text{discrete}})^t}$$

$$r_{\text{discrete}} = e^{r_{\text{continuously compounded}}} - 1$$

$$h^* = \rho_{S,F}.\frac{\sigma_S}{\sigma_F}$$

$$N^*_{\text{no tailing}} = h^*.\frac{Q_S}{Q_F}$$

$$N^*_{\text{tailing}} = h^*.\frac{V_S}{V_F}$$

$$F = S_0.e^{r.T}$$

$$f_{0,long} = S_0 - K.e^{-r.T}$$

$$f_{long} = -f_{short}$$

$$p = \frac{e^{rt} - d}{u - d}$$

$$u = e^{\sigma\sqrt{t}}$$

$$d = \frac{1}{u} = e^{-\sigma\sqrt{t}}$$

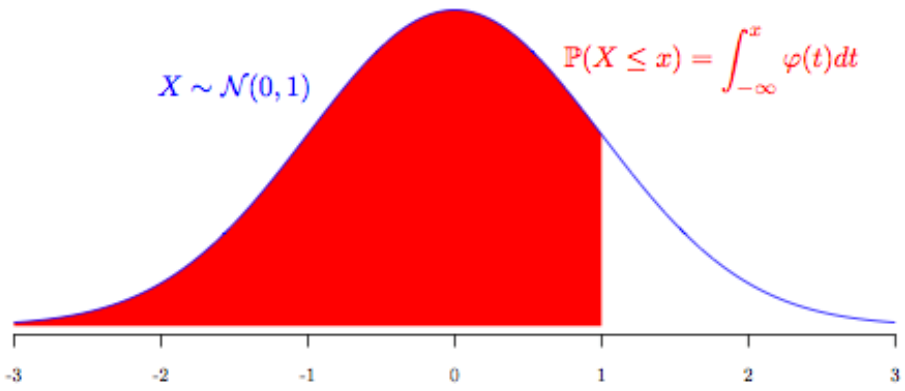
$$c_0 + K.e^{-r.T} = p_0 + S_0$$

$$c_0 = S_0.N(d_1) - K.e^{-r.T}.N(d_2)$$

$$p_0 = -S_0.N(-d_1) + K.e^{-r.T}.N(-d_2)$$

$$d_1 = \frac{\ln\left(\frac{S_0}{K}\right) + \left(r + \frac{\sigma^2}{2}\right).T}{\sigma.T^{0.5}}$$

$$d_2 = d_1 - \sigma.T^{0.5} = \frac{\ln\left(\frac{S_0}{K}\right) + \left(r - \frac{\sigma^2}{2}\right).T}{\sigma.T^{0.5}}$$



	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

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