Student Name:______________________________ Number: ______________

PART II – FIXED-INCOME DERIVATIVES AND MODELS

5. Basic Concepts – part II [2.5 points]

a) What is the meaning of FRA_{3x9}? Specify when this instrument is settled.

6 month - period forward rate fixed today to start 3 months from now.
The cash-settlement will occur 3 months from now

b) What are the credit risk components?

The credit risk (default risk) components are:
Exposure at default
Probability of default
Loss given default

c) Please classify the veracity of the following statements:

[True or false: + 0.25 values for each right answer;-0.15 values for each wrong answer]

1. Buying a put option on 3 months euribor future contracts allows us to fix a maximum value for the future value of the 3 months euribor rate.	T	F
2. The yield-to-put is calculated assuming the bond's option will be exercised.	T	F
3. The issuer of Floating Rate Note (FRN) may hedge the interest rate risk trough a floor.	T	F
4. We can hedge the risk of a rise in interest rates by buying 3M euribor futures contracts.	T	F
5. The value of a receiver swaptions is positively related with the interest rates.	T	F
6. Credit default swaps are traded in exchanges.	T	F

6. Swaps [2.5 points]

Consider the following interbank spot rates:

Term	1Y	2Y	3Y
rate	1,20%	1,30%	1,35%

a) Calculate the 3Y swap rate (annual fixed payment, semiannual floating payment – Euribor 6M)

b) Suppose you enter into the 3y swap contract paying the fixed leg, 6 month euribor rate: 0,8%, notional amount: 5.000.000 €.

b1) Calculate the first fixed and floating cash flow (assume the act/act market convention).

b2) What will be the value of your swap position if, one year from now, the interbank term structure of interest rates (spot rates) suffer a upward parallel shift of 50 basis points.

c) Describe two possible uses of swaps.

a) Swap rate = Par yield

3y Swap rate = 3Y par yield = $\frac{1 - B(0,3)}{\sum_{i=1}^{3} B(0,i)}$

$B(0,1) = \frac{1}{1,012} = 0,98814$

$B(0,2) = \frac{1}{(1,013)^2} = 0,97450$

$B(0,3) = \frac{1}{(1,0135)^3} = 0,96057$

3y Swap rate = $\frac{1 - 0,96057}{(0,98814 + 0,97450 + 0,96057)} = 1,3489\%$ //

b1) First fixed Cash-flow: Notional × fixed rate = 5000000 × 0,013489% = 67 445 € //

First floating Cash-flow (semiannual payment): notional × $\frac{\text{Euribor 6 Months}}{2}$ = $5\,000\,000 \times \frac{0,008}{2}$ = 20 000 € //

(Act/Act)

b2) New term structure (one year from now): Term: 1Y 2Y 3Y
Spot Rates: 1,70% 1,80% 1,85%

Floating leg = Par value = 100%

Fixed leg = $\frac{1,3489\%}{1,017} + \frac{101,3489\%}{(1,018)^2} = 99,1229\%$

Since you pay fixed/receive floating the value of the swap position = (Floating leg − Fixed leg)
= (100% − 99,1229%) × 5000 000 = 43 855 €

c) - Hedge against interest rate movements
- Optimize the financial condition of a debt
- create new synthetic assets
- Convert the financial conditions of a debt

choose 2

8. Bond Options [2 points]

Consider the following *lattice* for the 1 year interest rate:

		2,09%
	1,94%	
1,5%		2,01%
	1,86%	
		1,95%
t=0	t=1	t=2

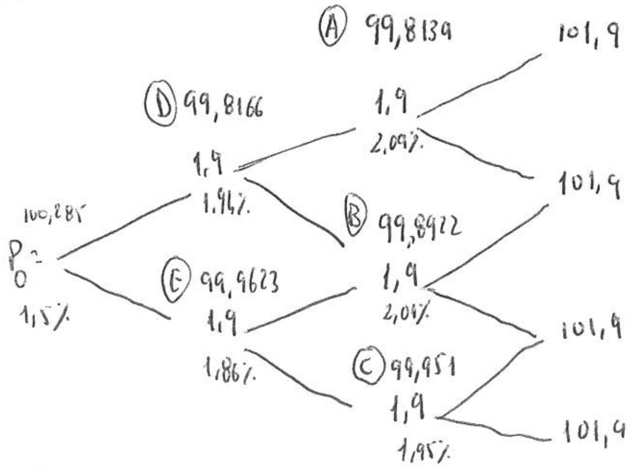
a) Calculate the value of a bond that matures in 3 years, with an annual coupon of 1.9% and pays par at maturity.
b) Calculate the value of a put option on the bond, with expiry date 2 years from now, 100% strike price and can be exercised at the end of the first and second year.

a)

(A) $\frac{0,5(101,9)+0,5(101,9)}{1,0209} = 99,8139$

(B) $\frac{0,5(101,9)+0,5(101,9)}{1,0201} = 99,8922$

(C) $\frac{0,5(101,9)+0,5(101,9)}{1,0195} = 99,951$



(D) $\frac{[0,5(99,8139)+0,5(99,8922)+1,9]}{1,0194} = 99,8166$ $t=1$ $t=2$ $t=3$

(E) $\frac{[0,5(99,8922)+0,5(99,951)+1,9]}{1,0186} = 99,9623$

$P_0 = \frac{[0,5(99,8166)+0,5(99,9623)+1,9]}{1,015}$

$P_0 = 100,285$

b) OPÇÃO PUT : PAYOFF = MÁX[100% - P ; 0]

Máx[100 - 99,8139; 0] = 0,1861

(value in continuity) → • $\frac{0,5(0,1816)+0,5(0,1078)}{1,0194} = 0,1442$

(Exercise) → • Máx[100 - 99,8166; 0] = $\boxed{0,1834}$

Máx[100 - 99,8922; 0] = 0,1078

$Put = \frac{0,5(0,1834)+0,5(0,077)}{1,015}$

$= 0,1283$

Value in continuity • $\frac{0,5(0,1078)+0,5(0,0490)}{1,0186} = \boxed{0,077}$

(Don't exercise) • Máx[100 - 99,9623; 0] = 0,0377

Máx[100 - 99,951; 0] = 0,0490

t=0 t=1 t=2

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7. Futures [2 points]

A manager holds a bond portfolio with the following characteristics:

Market value	$duration
6.960.230 €	-18.207.944 €

Assume he wishes to hedge interest rate risk using Euro Bund futures contracts maturing in September 2013 and currently priced at 142.77%. You know the cheapest to delivery bond is the Bund with 1.75% coupon rate, maturity 04/07/2022, 102.54% price, a modified duration of 8,178 and a conversion factor of 0.715427.

a) What is meant by "cheapest to delivery bond"?

b) Will the manager buy or sell contracts? Explain and compute the number of contracts that should be negotiated.

c) Assuming that the manager transacts the number of contracts calculated previously, what will be the result in the futures contracts if, two weeks later, he decides to close the futures position at a price of 139,50% (if you didn't answer the previous question assume a number of 20 contracts).

a) Is the bond, within the deliverable bond list of the future contract, that maximizes the difference between the amount received from the future contract settlement and the bond's acquisition cost in the cash market. (Is the bond that has the highest implied repo rate.)

b) To hedge the interest rate risk the manager should sell contracts since the portfolio is exposed to the risk of rising interest rates given the negative $duration of the portfolio.

$$\# \text{ contracts} = -\frac{\$\text{duration } p}{\$\text{ duration}_{\text{hedge inst}}} = -\frac{-18\,207\,944}{-[102{,}54\%(8{,}178)\times 100.000]} \times 0{,}715427 = -15{,}53$$

Should Sell 16 contracts at a price of 142,77%

c) $$\text{Result} = \underbrace{\frac{(142{,}77 - 139{,}50)}{0{,}01}}_{\Delta \text{ tick}} \times \underset{\text{Value of 1 tick}}{10\,€} \times \underset{\#\text{ of contracts}}{16} = 52\,320\ €$$

$$\left(\text{or: } (142{,}77\% - 139{,}50\%) \times 100\,000\,€ \times 16\right)$$