LISBON SCHOOL OF ECONOMICS & MANAGEMENT
UNIVERSIDADE DE LISBOA

Master in Mathematical Finance

Interest Rate and Credit Risk Models

Exam – 4 February 2019

Time: 2:15h

1. Please consider the following data about company Portex based in Portugal:

	04.12.2017	31.01.2019
Number of shares issued (Millions)	10	10
Nominal value of shares (€)	1	1
Market Value of shares (€)	1.2	0.6
Annualized volatility of share prices (%)	30	80
Short-term Liabilities (Million €)	8	30
Long-term Liabilities (Million €)	4	20
Annualized volatility of Market Value of Assets (%)	17	18
Market Value of Assets (Million €)	22	42
1-year interest rate (%)	0,2	0,2

1.1. Using structural models, identify the main changes between the 2 dates regarding the credit risk of Portex, detailing your calculations and presenting any additional assumption you may be required to consider (4,0)

1.2. Let us assume that, on the initial date referred in the previous question, you have bought 10 000 3-year bonds issued by the same company, whose rating then provided by S&P was A and the price was 104. Considering the information in the next table, what would be the 1-year Credit-Var at 95% for your portfolio of these bonds (3,0).

Ratings	1-year Probability of Transition	Estimated Price 1 year ahead
AAA	2,0%	115
AA	5,0%	110
A	85,5%	105
BBB	2,5%	95
BB	1,5%	85
B	1,4%	75
CCC	1,2%	70
D	0,9%	45

1.3. In order to mitigate your credit risk in the bond investment mentioned in the previous question, please describe how could you use credit default swaps and calculate the annual premium assuming that:

(i) the payment in case of default corresponds to the loss given default implicit in question 1.1;

(ii) the yield curve is completely flat;

(iii) the conditional marginal probabilities of default double every year since 1-year maturity. (3,0)

2. Please consider the following information on the Euro area money market and Government debt yields for the 31st January 2019:

Interest rates (%)

Maturities	Euribor	Germany	Portugal
Overnight	-0,40		
1 week	-0,38		
1 month	-0,37		
3 months	-0,30		
6 months	-0,24		
1 year	-0,11		
3 years		-0,45	-0,09
5 years		-0,30	0,47
10 years		0,175	1,67

2.1. Compute the price of a futures contract for the 3-month Euribor, with expiry date at the end of April 2019. (2,5)

2.2. Considering that the 3 and 5 year maturities of the Portuguese Government debt are represented by bonds paying annual coupons, with a redemption value of 1000 Euros and coupon rates of 1% and 2%, respectively, compute the number of 5 year bonds to use in a duration hedging strategy of a portfolio comprised by 100 bonds representative of the 3-year maturity. (2,5)

2.3. Assuming that the 2-year Portuguese Government bond has a redemption value of 1000 Euros and an annual coupon rate of 0,5%, compute the 2-year spot rate using a bootstrapping methodology and identify the main conceptual differences to the yield to maturity. (2,5)

2.4. Considering the main explanatory theories of the term structure of interest rates, characterize the major differences between the German and the Portuguese yield curve regarding the expectations on the future behavior of short-term rates (2,5)

   - Several theories, including the 2 versions of the expectations theory