



**Università Commerciale  
Luigi Bocconi**

**MSc. Finance/CLEFIN  
2017/2018 Edition**

## **Advanced Quantitative Methods for Asset Pricing and Structuring**

**May 2017 Exam for Attending Students**

Time Allowed: 55 minutes

Family Name (Surname)	First Name	Student Number (Matr.)

Please answer all questions by choosing the most appropriate alternative and/or by writing your answers in the spaces provided. You need to carefully justify and show your work in the case of “open” questions. There is only one correct answer for each of the multiple choice questions. Correct answers not selected and questions that have been left blank will receive zero points. Only answers explicitly reported in the appropriate box will be considered. No other answers or indications pointing to potential answers will be taken into consideration. In the case of “open” questions, the maximum number of points is indicated.

**Question 1.** Assume a CDS quoted spread is 300 basis points and the recovery rate is estimated to be 60%. Under the assumptions that i) the premium leg of the CDS pays continuously and ii) the hazard rate is constant, what is the value of the hazard rate? (2 pts)

- ☐ (A) 5%
- ☒ (B) 7.5%
- ☐ (C) 500
- ☐ (D) 750

**Question 2.** Which of the following statements about implied correlations is FALSE? (2 pts)

- ☐ (A) Base correlation can yield negative expected tranche losses
- ☐ (B) Typically, compound correlation depends on pairs of attachment points
- ☒ (C) Typically, implied correlation is consistent at the level of single tranche
- ☐ (D) Two tranches on the same pool (same maturity) may yield different values of compound correlation

**Question 3.** The following table shows, at different times (columns 1 through 5), the values of five trades as well as the future exposures to the counterparty, with and without netting.

Trade ID	1	2	3	4	5
1	10	-7	4	-6	-2
2	5	0	6	-2	4
3	7	5	5	6	-8
4	-7	6	-4	-6	-6
5	-5	-6	5	6	6
Exposures					
No Netting	22	11	20	12	0
Netting	10	-2	16	-2	0

Which of the following statement is TRUE? (2 pts)

- ☐ (A) There is one mistake
- ☐ (B) There are two mistakes
- ☒ (C) There are three mistakes
- ☐ (D) All exposures with “No netting” are correctly calculated

**Question 4.** Which of the following statements about CVA is TRUE? (2 pts)

- ☐ (A) CVA is defined as:  $CVA = LGD \mathbb{E}_0[\mathbb{I}_{\tau < T} (V(\tau))^+]$
- ☐ (B) CVA is defined as:  $CVA = LGD \mathbb{E}_0[\mathbb{I}_{\tau < T} D(0, \tau)(V(T))^+]$
- ☐ (C) CVA of an interest rate swap is a linear operation
- ☒ (D) None of the above

**Question 5.** Which of the following statements about Mapping methods for bespoke portfolios is TRUE? (2 pts)

- ☒ (A) Mapping consists in associating to the selected bespoke tranche an equivalent base tranche on a standard (index) portfolio
- ☐ (B) The Tranche Loss Proportion (TLP) method sometimes does not yield a solution
- ☐ (C) In the ATM method, the invariant measure of risk is the strike of the tranche
- ☐ (D) The ATM method works well when taking into account the dispersion of the portfolio

**Question 6.** Which of the following statements about Vasicek’s Portfolio Loss model is TRUE? (2 pts)

- ☐ (A) The mean of the portfolio loss distribution is a function of  $\rho$
- ☐ (B) It takes into account the effects of sector concentration
- ☐ (C) By the law of large numbers, the portfolio loss distribution is asymptotically normal
- ☒ (D) The Economic Capital is derived under the assumption that all the idiosyncratic risk has been diversified away

**Question 7.** Complete the following Table: (3pt)

	<b>Structural Models</b>	<b>Reduced Form (intensity-based) Models</b>
<b>Definition of default</b>		
<b>Exogenous/ endogenous</b>		
<b>Calibration to CDS</b>		
<b>Multi-name environment</b>		

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**Answer.**

	<b>Structural Models</b>	<b>Reduced Form (intensity based) Models</b>
<b>Definition of default</b>	<p>Default is defined in terms of:</p> <ol style="list-style-type: none"> <li>1. Stochastic process of the asset value of the firm</li> <li>2. Definition of the default barrier</li> <li>3. Definition of the default time (e.g. first passage time, barrier breach at maturity ...)</li> </ol>	<p>Default is defined in terms of:</p> <ol style="list-style-type: none"> <li>1. Default time = the first jump time of a Poisson process</li> <li>2. Hazard rate = probability of a default occurring in an infinitesimal time interval <math>[t, t+ dt)</math>, not having occurred before <math>t</math></li> </ol>
<b>Exogenous/ endogenous</b>	Endogenous	Exogenous jump process
<b>Calibration to CDS</b>	In general, difficult to calibrate to CDS. Analytically tractable first passage time models calibrate on volatility of the asset value and parameters of the barrier	Easy to calibrate to CDS through a bootstrapping algorithm which gives as output the intensity
<b>Multi-name environment</b>	Natural extension to the multi-name environment through the copula approach	Difficult to extend to the multi-name environment. Too low levels of dependence.

**Question 8.** Esteban works as a structurer at Gordon Socks Bank. He has been asked to provide some ideas of structured products to showcase in occasion of a meeting with potential clients. He is considering three possible underlyings. Considering the characteristics of each underlying provided below, which of the following statements is most appropriate? (2 pts)

<i>Underlying</i>	<i>Volatility</i>	<i>Dividend yield</i>
Eurostoxx 50	22%	1.30%
S&P 500	17%	2.00%
Ftse Mib	25%	1.00%

- ☐ (A) An Equity Protection certificate (with capital protection equal to 100%) that has Eurostoxx 50 as underlying will most likely have a higher participation to upside than an otherwise similar product that has S&P 500 as underlying
- ☒ (B) A Bonus Cap certificate with European barrier that has the Ftse Mib as underlying will pay a higher Bonus than an otherwise similar certificate that has the S&P 500 as its underlying
- ☐ (C) An Equity Protection certificate (with capital protection equal to 100%) that has Ftse Mib as underlying will most likely have a higher participation to upside than an otherwise similar product that has S&P 500 as underlying
- ☐ (D) A Bonus Cap certificate with European barrier that has the S&P 500 as underlying will have a higher Bonus than an otherwise similar product that has Eurostoxx 50 as underlying
- ☐ (E) None of the above

**Question 9.** You are pricing a Bonus Cap with an American barrier (observed continuously, at intra-daily frequency) using Monte Carlo simulations and assuming that the stochastic process for the underlying follows a log-normal random walk. You are assuming a time step  $t$  equal to one day (i.e., you are simulating the market closing price every day) Which of the following statement is most appropriate.(2 pts)

- ☐ (A) Because for a log-normal random walk we have an exact discretization scheme, you will only introduce an error  $O(N^{-1/2})$  due to the fact that you are using a finite number of simulations; such an error will decrease as the number of simulations increases
- ☐ (B) Because for a log-normal random walk we cannot exploit an exact discretization scheme, you will introduce an error  $O(\delta t)$  due to discretization and an error  $O(N^{-1/2})$  due to the fact that you are using a finite number of simulations
- ☒ (C) Although for a log-normal random walk we have an exact discretization scheme, the fact that the barrier is observed continuously intraday but you are simulating the price at the end of the day, leads to introducing an error of magnitude  $O(\delta t)$ , due to discretization and an error  $O(N^{-1/2})$  due to the fact that you are using a finite number of simulations
- ☐ (D) None of the above

**Question 10.** With reference to Fixed Leverage investment certificates (ICs) vs. Turbos which of the following statements is most likely correct? (2 pts)

- ☒ (A) Because of the compounding effect, when volatility is high, the performance of fixed leverage ICs tends to significantly diverge from the performance of the underlying; the compounding effect is a drawback of Fixed Leverage certificates
- ☐ (B) Because of the compounding effect, when volatility is low, the performance of fixed leverage ICs tends to significantly diverge from the performance of the underlying; the compounding effect is a drawback of Fixed Leverage certificates
- ☐ (C) Because of the compounding effect, when volatility is high, the performance of Turbos tends to significantly diverge from the performance of the underlying; the compounding effect is a drawback of Turbos
- ☐ (D) Because of the compounding effect, when volatility is low, the performance of Turbos tends to significantly diverge from the performance of the underlying; the compounding effect is a drawback of Turbos