Università Commerciale
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MSc. Finance/CLEFIN
2016/2017 Edition

Advanced Quantitative Methods for Asset Pricing and Structuring

June 2017 Exam for Non Attending Students

Time Allowed: 100 minutes

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

Please answer all questions by choosing the most appropriate alternative(s) 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(s) 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. Which of the following statements about Reduced Form (Intensity) models is FALSE? (1.5 pts)

☐ (A) Default is described by means of an exogenous jump process
☐ (B) The probability of having more than one jump in any arbitrarily small time interval goes to zero faster than time
☐ (C) Close to default, intensities typically present an inverted term structure
☑ (D) Survival probabilities obtained through calibration to CDS quotes are always a decreasing function of time

Question 2. Which of the following statements about First Passage Time models is FALSE? (1.5 pts)

☐ (A) Default occurs if the firm's asset value hits the barrier from above
☐ (B) Both the barrier and the volatility of the asset may be time-dependent
☑ (C) Typically, the number of parameters to be calibrated exceeds the number of market quotes
☐ (D) In AT1P, the number of parameters to be calibrated exceeds the number of market quotes

Question 3. Consider a standard CDS Index (e.g., i-Traxx). Which of the following statements is FALSE? (1.5 pts)

☐ (A) The copula is parametrized by a matrix of 7750 pairwise correlation values
☑ (B) The copula is parametrized in terms of a unique pairwise correlation value
☐ (C) The one-factor Gaussian copula is parametrized by a matrix of 125 pairwise correlation values
☐ (D) At the level of single tranche, it is market practice to infer a unique compound correlation parameter from the tranche price

Question 4. The following table shows, at different times (columns 1 to 5), the values of four trades as well as the future exposures to the counterparty, with and without netting.

Trade ID	1	2	3	4	5
1	2	3	2	-3	-8
2	5	0	-7	-5	0
3	3	5	5	3	-8
4	-3	-10	-2	-3	-2
Exposures					
No Netting	7	8	7	3	-18
Netting	10	-2	-2	0	0

Which of the following statement is TRUE? (2 pts)
☐ (A) There are four mistakes
☑ (B) There are two mistakes in the "No Netting" exposures
☐ (C) There are two mistakes in the "Netting" exposures
☐ (D) All exposures with "No netting" are correctly calculated

Question 5. Which of the following statements about counterparty exposure is FALSE? (2 pts)

☑ (A) At any given future time, it is given by the market value of the portfolio of derivative positions with a counterparty that would be lost if the counterparty were to default with zero recovery at that time
☐ (B) At any given future time, the PFE is given by a quantile of the counterparty exposure
☐ (C) Expected exposure (EE) is the average exposure on a future date
☐ (D) Expected positive exposure (EPE) is the average EE in time up to a given future date

Question 6. Which of the following statements about implied correlations is TRUE? (1.5 pts)

☐ (A) It always yields positive expected tranche losses
☐ (B) Typically, it depends on pairs of attachment points
☐ (C) Two tranches on the same pool (same maturity) may yield different values of base correlation
☑ (D) Two tranches on the same pool (same maturity) may yield different values of compound correlation

Question 7. Which of the following statements about the Vasicek process is FALSE? (1.5 pts)

☐ (A) The solution to a Vasicek process may assume negative values
☑ (B) The solution to a Vasicek process is a good candidate to describe stochastic intensities
☐ (C) The solution to a Vasicek process is distributed as a Gaussian variable
☐ (D)The solution to a Vasicek process tends to revert to its long term level

Question 8. Which of the following statements about Mapping methods for bespoke portfolios is TRUE? (1.5 pts)

☐ (A) The ATM method is a good modelling choice for a portfolio of names with a skewed loss distribution
☐ (B) The market invariant risk measure of the ATM method is the fraction of the total expected portfolio loss which resides in a given base tranche
☑ (C) Extrapolation assumptions may be needed for the Probability Matching (PM) method
☐ (D) The Tranche Loss Proportion (TLP) method is the only method based on a correlation assumption depending on the equivalent strike

Question 9. Which of the following statements about the Vasicek Portfolio Loss model is FALSE? (1.5 pts)

☐ (A) If the events of default on the loans in the portfolio were independent of each other, the portfolio loss distribution would converge, by the central limit theorem, to a normal distribution as the portfolio size increases
☑ (B) If the events of default on the loans in the portfolio were independent of each other, the portfolio loss distribution would converge, by the central limit theorem, to a limiting loss distribution as the portfolio size increases
☐ (C) The portfolio loss distribution may be bell-shaped
☐ (D) The model assumes a single risk factor

Question 10. Let the variable $X \sim \mathcal{N}(0,1)$ and $Y = X^3$. Which of the following statements is TRUE? (1.5 pts)

☐ (A) X has a richer information content with respect to Y
☐ (B) Y has a richer information content with respect to X
☐ (C) X and Y have maximum correlation
☑ (D) X and Y have maximum dependence

Question 11. What is Directional Way Risk? Give definitions and example of:

- Wrong Way Risk (1.5 pts)
- Right Way Risk (1.5 pts)

Answer. See Lecture "Introduction to Counterparty Risk", slides 36-38.

Question 12. (3 pt) Describe a CDS contract, specifying:

- how it can be settled
- the cash flows associated to it

Answer. See Lecture "Single Name Credit Derivatives", slides 18 and 20-22.

Question 13. Logan is a structurer at Morgan Stanlio & Olio Bank. His new junior assistant, Guido, has just priced two different Bonus Cap certificates with the characteristics below. This means that Guido has set the percentage bonus of each which makes their price equal to 100. After looking at the bonus percentages, Logan asks Guido to double check them, because he thinks they may be incorrect. What is MOST LIKELY to have made Logan suspicious? (1.5 pts)

	Bonus Cap A	**Bonus Cap B**
Underlying	Ftse Mib	Eurostoxx 50
Barrier level/type	70% American	70% European
Bonus	120%	121%
Cap	120%	120%
Volatility of the underlying	21%	20%
Dividend yield	2.1%	2.0%

☐ (A) Logan is wrong to be suspicious because the volatilities and dividend yields of the two underlyings are very similar, so it is likely that the Bonus amounts for the two certificates are similar and the bonus of B may exceed that of A

☐ (B) Logan is right not to believe that the prices are correct because the two Cap percentages cannot be equal to the Bonus amount

☐ (C) Logan is right not to believe that the prices are correct because the barrier of the Bonus Cap B is European, so the Bonus amount should be much higher than the Bonus amount of certificate A, given that volatilities and dividend yields of the two underlyings are very similar

☑ (D) Logan is right not to believe that the prices are correct because the barrier of the Bonus Cap A is American, so the Bonus amount should be much higher than the Bonus of certificate B, given that volatilities and dividend yields of the two underlyings are very similar

Question 14. An outperformance certificate is:

☐ (A) A certificate with capital protection and one-to-one participation to potential appreciation of the underlying

☐ (B) A certificate with capital protection and magnified participation to potential appreciation of the underlying

☐ (C) A certificate with conditional capital protection and one-to-one participation to potential appreciation of the underlying

☑ (D) None of the above

Question 15. Julian, a junior structurer at BPN Bank, has been asked to price a 2-year Bonus Cap certificate characterized by an American barrier and he is confused about how exactly he could do that. Dr. Greyhead, a senior colleague of his who has earned a PhD in Economics, decides to help him. What is Greyhead MOST LIKELY to suggest? (1.5 pts)

☐ (A) He would suggest to use Black and Scholes pricing model applied to the different options that replicate the Bonus Cap certificate

☑ (B) He would suggest to use Montecarlo simulations assuming that the stochastic process for the underlying follows a log-normal random walk and assuming a time step t equal to 1 day (i.e., he would simulate the market closing price every day). The choice of a time step of 1 day would help keeping the error due to discretization under control

☐ (C) He would suggest to use Montecarlo simulations assuming that the stochastic process for the underlying follows a log-normal random walk and assuming a time step t equal to 1 month (i.e., he would simulate the market closing price at the end of every month). The choice of a time step of 1 month would help keeping the error due to discretization under control

☐ (D) He would suggest to use Montecarlo simulations assuming that the stochastic process for the underlying follows a log-normal random walk. However, the choice of the time step t turns out not to be important as, by assuming a log-normal distribution for the underlying asset price, he is using an exact discretization scheme

Question 16. The matrix below shows the pair-wise correlations between returns on three different stocks. For simplicity, assume the stocks are characterized by the same volatility. Which of the proposed combinations of stocks will allow the highest possible participation rate to upside movements for an equity protection certificate written on the price of an equally weighted basket of **two only of these three stocks** as its underlying? (1.5 pts)

	Univeler	Trotter	Brambo
Univeler	1		
Trotter	0.7	1	
Brambo	0.2	0.5	1

☑ (A) Brambo and Univeler followed by Brambo and Trotter

☐ (B) Trotter and Univeler, followed by Brambo and Trotter

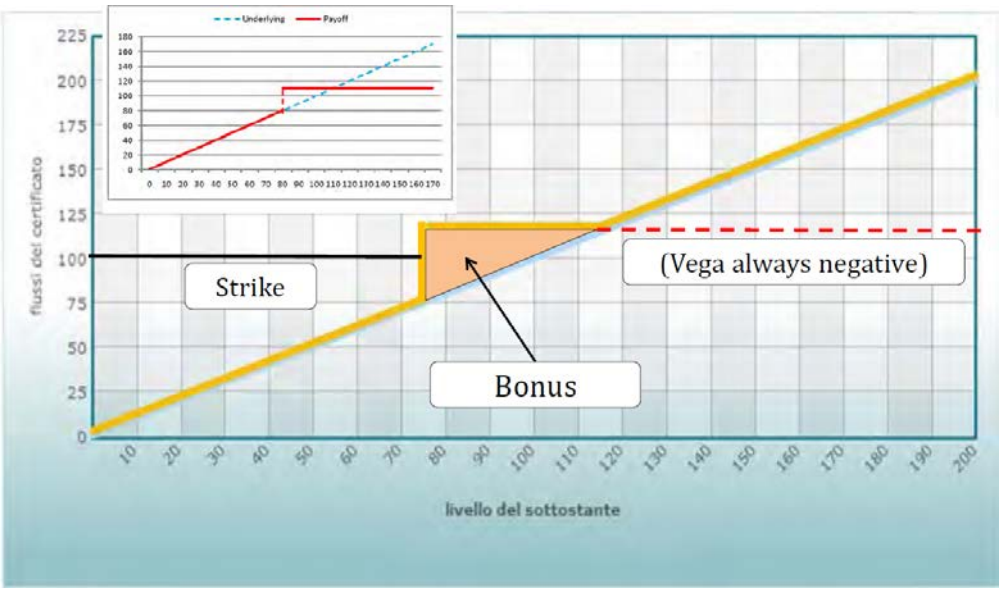
☐ (C) Brambo and Unilever, followed by Univeler and Trotter

☐ (D) Trotter and Brambo

Question 17. After having drawn the payoff of a Bonus Certificate (without cap and with a European barrier), fill out the table below concerning some of its Greeks assuming the product has just been issued. Provide a short comment on the sign of each of these Greeks (3 pts)

Greek	**Sign of the Greek**
Delta	
Vega	
Theta	

Answer



- Vega is negative for long-term Bonus Caps because as volatility increases, the chances that the barrier is hit increase
- When the Bonus Cap is ATM and close to maturity, on net volatility has a weak positive effect on price because of the linear upward segment
- Theta is positive because it makes less likely to hit the barrier
- Dividends reduce the value of the underlying and such they penalize the performance of a Bonus Cap

Variabili	Emissione	Barriera toccata**	Scadenza (prossimità)***
(↑) Sottostante	↑	↑	↑
(↑) Volatilità	↓	=	↑
(↑) Tempo*	↑	=	↑
(↑) Tassi d'interesse	↓	↓	↓
(↑) Dividendi	↓	↓	=

Close to strike price