Math 632   **Name (Print):** _____
Fall 2019
Final exam
12/11/19

This exam contains 16 pages (including this cover page) and 13 problems. Check to see if any pages are missing. Enter all requested information on the top of this page, and put your initials on the top of every page, in case the pages become separated.

You may use 1 pages of note (two sided) on this exam.

You are required to show your work on each problem on this exam. The following rules apply:

- **Organize your work**, in a reasonably neat and coherent way, in the space provided. Work scattered all over the page without a clear ordering will receive very little credit.

- **Mysterious or unsupported answers will not receive full credit**.

Problem	Points	Score
1	10	
2	25	
3	10	
4	20	
5	15	
6	15	
7	30	
8	10	
9	10	
10	10	
11	15	
12	10	
13	20	
Total:	200	

1. (10 points) Suppose that the principals assigned to the senior, mezzanine, and equity tranches for a certain ABSs and ABS CDOs are 80%, 15% and 5%. Complete the following table

Loss to subprime portfolios	Loss to ABS Mezz tranche	Loss to ABS CDO Mezz tranche	Loss to ABS CDO senior tranche
10 %			
15 %			
20 %			
25 %			

2. (a) (5 points) What are the differences between OTC and exchange traded markets ? Why would bank prefer OTC and regulators prefer exchange traded markets?

(b) (5 points) Give some names of important exchange traded markets.

(c) (5 points) What are initial margins and variation margins? What are their differences ?

(d) (5 points) What is CCP. Give examples of some important CCPs.

(e) (5 points) What is a hair cut? Why is it needed ? Can we get it at SuperCuts ?

3. (10 points) JP Morgan has entered into a forward contract to buy 1,000 shares of APPL from Goldman in 2 years for 200 dollars per share. The current 2 year forward price of AAPL is 250 dollars per share. The volatility of the forward price of AAPL is 30% per annum. We suppose that only two intervals each 1 year long are considered in the calculation of CVA and DVA. The hazard rate of JP for the first year is 0.01 % and year 2 is 0.011 %. The hazard rate of Goldman for the first year is 0.009 % and year 2 is 0.01 %. A 70 % recovery in the event of default is anticipated. Find the **CVA** value of the forward contract for JP at time 0.

4. Suppose that the risk-free rate is 2 % per annum (continuous compouding). Consider a company who issued a 1 year bond with face value $ 100 and coupon rate 3 % per year (semi-annual coupon). The 1 year bond yield is 4 %.

   (a) (5 points) Find the current price of the 1 year bond.

   (b) (5 points) Suppose the recovery rate is 40 %. Find a rough estimate of the hazard rate of the company during the first year.

   (c) (5 points) What is a rough estimate of the probability that the company will default somewhere within the 5th and 7th month?

   (d) (5 points) The company also issue a 2 year bond with the same specifications on face value and coupon rate. Its yield is 5.5 %. Estimate the probability that the company defaults somewhere between the 10th month of the first year and the 5th month of the 2nd year.

5. (a) (5 points) When and where did Basel I take place? What was the most significant regulation that came out of Basel I? What type of risk did it addresss?

   (b) (5 points) What is netting ? What kind of financial products that netting address? What is the significance of netting for the bank?

   (c) (5 points) What was the most significant regulation that came out of the 1996 Amendment of Basel I, also known as the BIS 98? What is BIS?

6. A portfolio consists of 100 bonds of the same rating whose hazard rate in the first year is 0.4.

   (a) (5 points) Find the portfolio 99% 1 year credit VaR if the bond default times all have correlations 1.

   (b) (5 points) Find the portfolio 99% year credit VaR if the bond default times are independent.

   (c) (5 points) Find the approximate portfolio 1 year credit VaR if the default times all have correlations $\rho = 0.5$.

7. (a) (5 points) When did Basel II.5 take place? What are its important feature?

   (b) (5 points) What is incremental risk change and what area of bank activities does it address?

   (c) (5 points) When did Basel III take place? What type of new risk does it address? What is the bank's leverage ratio and what problem does it address?

   (d) (5 points) What is CoCos and why is it attractive for both regulators and banks?

(e) (5 points) What is G-SIBS? Name some important G-SIBS.

(f) (5 points) Name 3 aspects of Dodd-Frank that you find relevant and interesting.

8. (a) (5 points) A portfolio consisting of 1500 dollars in Tesla and 1000 dollars in Ford's stocks. Suppose the correlation between Tesla and Ford's returns is 0.2 and the daily volatility of Tesla is 0.5% while the daily volatility of Ford is 0.8%. Find the daily 95 % VaR of the portfolio.

(b) (5 points) A portfolio of options on Google stocks have a delta of 40. The current Google stock price is 1,400 USD. If the daily volatility of Google is 0.4 %, estimate the 99% VaR of the portfolio.

9. (a) (5 points) An investor has shorted 5,000 dollars in shares of company A and long 3,000 dollars in shares of company B. The proportional bid-ask spread for A is 0.01 and for B is 0.02. What is the cost of unwinding this portfolio?

(b) (5 points) Suppose further that the bid-ask spread of A (resp. B) has a mean 0.01 (resp. 0.02) and standard deviation of 0.01 (resp. 0.03). Both are normally distributed. What is the 99 % worst case cost of unwinding the portfolio?

10. Suppose a 1 year bond that pays coupon with rate 3 % with semiannual coupon and face value 100 dollars is currently selling for 95 dollars. Also suppose the current risk free rate is 4 % per annum, compound continuously.

   (a) (5 points) Find the yield and the yield spread of the bond.

   (b) (5 points) Find the asset swap spread where one side pays the coupon rate of the bond and the other side pays LIBOR + spread. Verify that this spread is similar to the one you found in part a.

11. (a) (5 points) When did Basel II take place? What part of Basel I did it modify / update? What type of new risk did it add in addition to the ones from Basel I ?

(b) (5 points) What are the 3 pillars of Basel II?

(c) (5 points) What is the IRB approach ? What model is it based on and what is its drawback?

12. (10 points) Create an example where there are 4 banks, one CCP and 2 product types (similar to figure 17.4 in John Hull, but with 4 banks). You should present 2 diagrams: one with only the 4 banks, bilateral clearing and their individual exposures in this case; one with the 4 banks and the CCP, one product is cleared with the CCP and one is not cleared with the CCP and the banks' exposures in this case. You must make sure that the net cash flow in both diagrams to the bank are the same. Does the case with the CCP result in higher total exposures for the banks? You can assume at most 2 banks that do not have transactions with each other.

13. (a) (5 points) What risks are included by regulators in their definition of operational risks? What risks are not included?

(b) (5 points) Discuss how moral hazard and adverse selections are handled in car insurance.

(c) (5 points) Discuss whether there is i) moral hazard ii) adverse selection in life insurance contracts.

(d) (5 points) Suppose that there is 90 % probability that operational risk losses of a certain type will not exceed 20 million. The power law parameter, α, is 0.8. What is the probability that the losses exceed 80 millions?