Delft University of Technology Mekelweg 4
EWI Faculty 2628 CD Delft

Risk Management WI3421TU
Final Exam
January 21st 2014, 18.30-21.30

The language of this exam is English.
Please only use the paper sheets here provided. If you need more, just ask.
You can make use of a non-programmable calculator and of a cheat-sheet (A4 only front) containing formulas. No definition, no exercises on it. I will pass and sign it during the exam.
Please provide your student card on the table, ready for inspection.
Mobiles, tablets and similar objects must be switched off.
During the first hour you cannot leave the room, even if you decide not to hand your exam in.
After the first hour, if you need to go to the toilet (max one person at a time) you have to temporarily hand your exam in.
The exam is invalidated if you cheat, use your mobile, etc.
Please write with a pen. Pencils are not accepted.
A standard normal table is available in the last page of the exam.

Please write your name, surname and student number.
If you have not registered for the exam, your exam will not be corrected, according to the new TU Delft regulations.

Good Luck!

Name: ..... **Surname:** ..... **Student Number:** .....

Are you re-sitting for this exam? YES (Already tried once) NO (This is my first time)

Part 1: Multiple Choice Questions [30% of the grade]

Please notice: Each question may have **more than one** correct answer. A question is fully answered if all the right statements are marked.
Every wrong answer deletes a correct one. However you cannot score less than 0.

In your computations, round off the final result to the second decimal place: e.g. $1.534 \to 1.53$, $1.537 \to 1.54$.

1. A coherent measure of risk shows:

A. Super-additivity.

B. Monotonicity.

C. Translation Invariance.

D. Possible Homogeneity.

E. Convexity.

2. We have two assets: X and Y. Their correlation is $\rho(X, Y) = 0$. Find the false statement(s):

A. The covariance between X and Y is 0.

B. The covariance between Y and X is 0.

C. X and Y are uncorrelated.

D. X and Y are linearly dependent.

E. X and Y may be non-linearly dependent.

3. We own a portfolio that only contains one single linear product. Therefore:

A. If the portfolio is made Delta neutral, then it is also Gamma neutral.

B. If the portfolio is made Gamma neutral, then it is also Delta neutral.

C. Our portfolio possesses the so-called "hedge and forget" property.

D. The portfolio is optimal.

E. Our portfolio minimizes the standard deviation.

4. Under continuously compounded rates, we have the following zero rates:

Maturity (in years)	zero rate in %
0.5	5.2
1.0	5.8

The forward rate for the period from 6 months to 1 year is hence

A. 5.80%.

B. 5.20%.

C. 6.40%.

D. 6.60%.

E. None of the previous answers.

5. Consider a 2-year bond with a par value of 100 euros that pays 5 euros per annum semiannually. The market price of the bond is 98.97. Then the yield is more or less:

A. 5.32%.

B. 5.47%.

C. 5.85%.

D. 6.00%.

E. It is not possible to say, because of a lack of data.

F. None of the previous answers.

6. According to a rating agency, we have the following cumulative default rates for companies rated XXX:

time (in years)	cumulative default rate in %
1	2.12
2	4.05
3	6.33
4	8.24

What is the probability that a company belonging to the class XXX will default during the second year?

A. 2.28%.

B. 4.05%.

C. 2.12%.

D. 1.93%.

E. None of the previous answers.

7. Suppose that each of two investments has a 4% chance of a loss of 10 million, a 2% chance of a loss of 2 million, a 93% chance of a loss of 1 million, and a 1% chance of a profit of 6 million. They are independent of each other.

A. The 95% VaR is 1 million for each of the investments.

B. The 95% VaR is 2 million for each of the investments.

C. The 95% ES is 8.4 million for each of the investments.

D. The 95% VaR is 9 million for the two investments combined together.

8. You are offered an investment of 1000 euros in copper. There is a 10% chance of a large profit (greater than 30%!), and a 90% chance of a loss. Losses are uniformly distributed between 0 and 100 euros. Consider the 95% VaR and ES. Then:

A. VaR = 93.81 and ES = 96.90.

B. VaR = 94.44 and ES = 97.22.

C. VaR = 94.70 and ES = 97.35.

D. VaR = 95.00 and ES = 97.50.

E. VaR = 97.50 and ES = 98.20.

9. The covariance between two assets X and Y is 0.6. The volatility of X is $\sigma_X = 1$. The volatility of Y is $\sigma_Y = 2$. Consider Figure 1, containing 4 possible scatterplots of X and Y. Which graph better represents the relationship between X and Y?

A. Graph A.

B. Graph B.

C. Graph C.

D. Graph D.

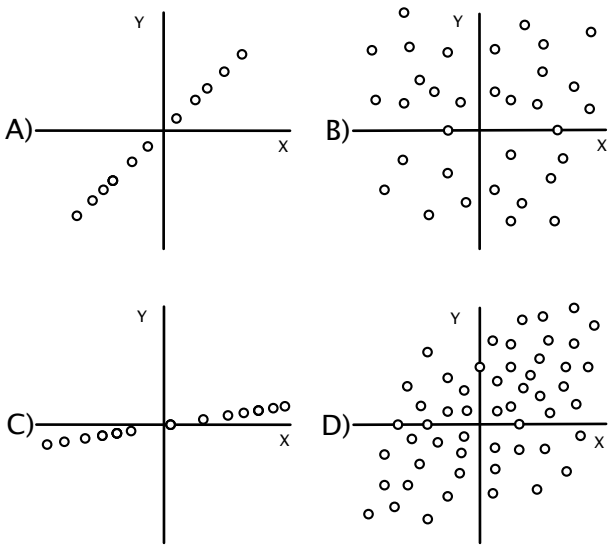

Figure 1: Scatterplots of X and Y.

10. On the basis of historical data, the daily losses of an investment in dollars are well approximated by a Gaussian distribution with mean 1 and variance 4. The 99% daily VaR is therefore:

A. 2.33.

B. 4.65.

C. 5.65.

D. 9.31.

E. 10.31.

Part 2: Open Questions [35% of the grade]

Please: Write clearly and try to be as complete as possible without useless digressions. Open questions are "open" but rather precise. The given space should be sufficient. However, if you need more space, you can use additional paper.
Open questions give different points. You can find the actual values in the brackets.

1. What are the main differences between Merton's model and the KMV model? [1.5 Points]

2. What is Operational Risk? What are the main approaches we can use to assess it? [1 Points]

3. Describe the main aspects of the Basel II agreements. [1 Points]

Part 3: Exercises [35% of the grade]

Please: Write clearly and provide the computations you have used to obtain the results. Missing computations may halve the points.
To speed up corrections, please write your results here below on the dotted lines. Computations (that you have to provide) can be in the attached sheets. The actual value of each exercise is in the brackets.

1. A bank has 20 billion euros of one-year loans and 35 billion euros of five-year loans. These are financed by 45 billion of one-year deposits and 10 billion of five-year deposits. The bank has equity totaling 3.75 billion euros and its return on equity is currently 10%. The bank is subject to a tax rate of 25%.
Estimate what change in interest rates next year would lead to the bank's return on equity being reduced to zero. [1 Point]

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2. Consider a portfolio of options on a single asset. Suppose that the Delta Δ of the portfolio is 15, the value of the asset is 10 pounds, and the daily volatility of the asset is 2.2%. Estimate the one-day 98% VaR for the portfolio from the Delta. [1 Point]

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3. Be careful: you have to give 2 answers. The volatility of an asset is 25% per annum (commercial year: 252 days). What is the standard deviation of the percentage price change in one trading day (1st answer)? Assuming a Gaussian distribution with zero mean, estimate the 95% confidence interval for the percentage price change in one day (2nd answer). [1 Point]

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4. The expected return on the market is 9% and the risk-free rate is 2%. The standard deviation of the market portfolio is 6%.
One investor creates a portfolio on the efficient frontier with an expected return of 12%. Another builds an efficient portfolio with an expected return of 18%.
What is the standard deviation of the returns of the two portfolios? [0.5 Points]

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Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9031	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9924	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9958	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986

Figure 2: Standard Normal Distribution Table