Delft University of Technology
EWI Faculty

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Risk Management WI3421TU
Final Exam Simulation - December 2016
The real exam is longer, because you have 3 hours!

The language of the exam is English.
Please write your name, surname and student number.
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 for your convenience.
Good Luck!

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

Part 1: Multiple Choice Questions [30%]

Please notice: Each question may have more than one correct answer.

1. We have two assets: X and Y. Their covariance is $\sigma(X, Y) = 0$. Then we can say that:

A. X and Y are uncorrelated.

B. X and Y are independent.

C. $Y \neq X$.

D. $X = Y$.

E. X and Y are not linearly dependent.

2. The following table shows zero rates for different maturities:

Maturity (in years)	1	2	3	4	5	7	10
Yearly Rate %	4.0	4.5	4.8	5.0	5.1	5.2	5.3

We have a bond with a face value of 2000 pounds, a maturity of 3 years and a yearly coupon equal to 5%. We assume continuous compounding. The duration of the bond in years is

A. 2.27

B. 2.62

C. 2.86

D. 2.98

E. 3.01

3. An investment has a 4% chance of a loss of 10 million, a 2% chance of a loss of 1 million, and a 94% chance of a profit of 1 million. What about the 95% VaR and ES?

A. They are both equal to 5 million.

B. The 95% VaR is 1 million and the expected shortfall is 8.2 million.

C. The 95% VaR is 10 million.

D. The 95% ES is 2.5 million.

E. The 95% VaR is sub-additive.

F. In this case both the VaR and the ES are coherent.

4. You are a bank and you enter into a forward contract with a corporate client.
You agree to sell 1 million euros for 1.4 million dollars in one year. The 1-year interest rates are 1.25% for euros and 0.75% for dollars. Assume that, today, with 1 euro you can buy 1.37 dollars. What is approximately (without decimals) the value in dollars of our forward contract today?

   A. 35778.

   B. 35941

   C. 36114.

   D. 36392.

   E. None of the previous answers.

5. When using credit ratings, a fundamental assumption is

   A. that a rating fully determines the PD of a company

   B. that a rating fully determines the default of a company.

   C. that a rating is reliable only if it is produced by one of the three major rating agencies.

   D. that a rating is not sufficient to fully determine the PD of a company; we need at least two different ratings, from different agencies.

Part 2: Open Questions [30%]

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.
Open questions give different points. You can find the actual values in the brackets.

1. Describe the basic characteristics of the Merton's model, showing how we obtain the very convenient representation of equity and debt in terms of European options.

2. What are the main approaches to credit risk, according to Basel II? What are the main differences?

Part 3: Exercises [40%]

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 a separate sheet. The actual value of each exercise is in the brackets. Statistical tables are provided.

1. We want to back-test the $VaR_{0.98}$ of a portfolio consisting of two investments. We have 1200 days of data and we observe 19 exceedances. We set the significance level for the test to be 4%. Should we reject the VaR?

   .....

   Here is a table that could be useful for you.
   The table contains $P(X \leq n)$ for $X \sim Binomial(n, 1200, p)$.

   Table 1: Distribution function of a $Binomial(n, 1200, p)$ random variable.

$P(X \leq n)$	$p = 0.01$	$p = 0.02$	$p = 0.03$
n=16	0.8998	0.0545	0.0001
n=17	0.9380	0.0849	0.0002
n=18	0.9633	0.1258	0.0006
n=19	0.9793	0.1776	0.0012
n=20	0.9888	0.2401	0.0024

2. For a Caa-rated bond we know that the cumulative probability of defaulting during years one, two, three, four, and five, are 18.163%, 30.204%, 39.709%, 47.317%, and 53.768%, respectively.

   a. What is the probability that the Caa-rated bond will default during year 1? .....

   b. What is the probability that the Caa-rated bond will NOT default before the end of year 2? .....

   c. What is the probability that the Caa-rated bond will default during year 3, conditional on no earlier default? .....

3. Consider Figure ??, containing a 1-year transition matrix by Moody's.

   Consider a Baa-rated company. With X we indicate the standardized asset value of the company at the end of year 1.
   According to CreditMetrics:

   a. The company defaults if X is smaller than/equal to: .....

   b. The company moves to the Aaa-class if X is larger than: .....

   c. The company remains in the Baa class if X is in the interval: .....

Standard Gaussian N(0,1) Table: $\bar{\Phi}(q) = 1 - \Phi(q) = P(Z \geq q)$.
Decimal values, i.e. $0.xxxx$. Example: $5000 \rightarrow 0.5000$.

q	0	1	2	3	4	5	6	7	8	9
0.0	5000	4960	4920	4880	4840	4801	4761	4721	4681	4641
0.1	4602	4562	4522	4483	4443	4404	4364	4325	4286	4247
0.2	4207	4168	4129	4090	4052	4013	3974	3936	3897	3859
0.3	3821	3783	3745	3707	3669	3632	3594	3557	3520	3483
0.4	3446	3409	3372	3336	3300	3264	3228	3192	3156	3121
0.5	3085	3050	3015	2981	2946	2912	2877	2843	2810	2776
0.6	2743	2709	2676	2643	2611	2578	2546	2514	2483	2451
0.7	2420	2389	2358	2327	2296	2266	2236	2206	2177	2148
0.8	2119	2090	2061	2033	2005	1977	1949	1922	1894	1867
0.9	1841	1814	1788	1762	1736	1711	1685	1660	1635	1611
1.0	1587	1562	1539	1515	1492	1469	1446	1423	1401	1379
1.1	1357	1335	1314	1292	1271	1251	1230	1210	1190	1170
1.2	1151	1131	1112	1093	1075	1056	1038	1020	1003	0985
1.3	0968	0951	0934	0918	0901	0885	0869	0853	0838	0823
1.4	0808	0793	0778	0764	0749	0735	0721	0708	0694	0681
1.5	0668	0655	0643	0630	0618	0606	0594	0582	0571	0559
1.6	0548	0537	0526	0516	0505	0495	0485	0475	0465	0455
1.7	0446	0436	0427	0418	0409	0401	0392	0384	0375	0367
1.8	0359	0351	0344	0336	0329	0322	0314	0307	0301	0294
1.9	0287	0281	0274	0268	0262	0256	0250	0244	0239	0233
2.0	0228	0222	0217	0212	0207	0202	0197	0192	0188	0183
2.1	0179	0174	0170	0166	0162	0158	0154	0150	0146	0143
2.2	0139	0136	0132	0129	0125	0122	0119	0116	0113	0110
2.3	0107	0104	0102	0099	0096	0094	0091	0089	0087	0084
2.4	0082	0080	0078	0075	0073	0071	0069	0068	0066	0064
2.5	0062	0060	0059	0057	0055	0054	0052	0051	0049	0048
2.6	0047	0045	0044	0043	0041	0040	0039	0038	0037	0036
2.7	0035	0034	0033	0032	0031	0030	0029	0028	0027	0026
2.8	0026	0025	0024	0023	0023	0022	0021	0021	0020	0019
2.9	0019	0018	0018	0017	0016	0016	0015	0015	0014	0014
3.0	0013	0013	0013	0012	0012	0011	0011	0011	0010	0010
3.1	0010	0009	0009	0009	0008	0008	0008	0008	0007	0007
3.2	0007	0007	0006	0006	0006	0006	0006	0005	0005	0005
3.3	0005	0005	0005	0004	0004	0004	0004	0004	0004	0003
3.4	0003	0003	0003	0003	0003	0003	0003	0003	0003	0002