Winter term 2012/2013 February 14, 2013

20041: Risk Controlling (Prof. Dr. Reichling)

Please read the following instructions before you start to work on the exam.
1. The exam consists of **four** problems. **All** have to be solved.
2. Please explain and justify your answers in a comprehensive manner.
3. Only a non-programmable calculator and unmarked English dictionaries are allowed.
4. You have 60 min. to work on the exam.

Good Luck!

Problem 1 (Stochastic Dominance) 8 points

Test the following three investments with respect to their stochastic dominance (of first order and second order). Justify your answer.

State i		1	2	3
Probability p_i		0.3	0.4	0.3
Investment A	Cash flow $_A$	35	40	5
Investment B	Cash flow $_B$	25	45	10
Investment C	Cash flow $_C$	10	5	10

Problem 2 (Safety-First Criteria) 20 points

Consider two risky stocks, 1 and 2, with the following properties:

	Stock 1	Stock 2
μ (expected return)	15%	5%
σ (volatility)	10%	5%
$\rho_{1,2}$ (correlation coefficient)	-0.5	
x (shares of minimum variance portfolio)	1/3	2/3

a) If short sales are allowed, determine the optimal portfolio according to Roy's criterion using a target return $\tau = 5\%$ p.a. What is the corresponding shortfall probability? (Hint: Use the Lagrangian approach)

b) What assumption do you have to make regarding the utility function so that Roy's criterion is consistent with the expected utility theory? Does it hold for risk averse investors? Why?

Problem 3 (Value at Risk of Stocks) 22 points

Consider the following variance-covariance matrix of multivariate normally distributed daily returns of two stocks, the appropriate index and the betas:

	Commerzbank	RWE	DAX
Commerzbank	0.19	0.06	0.09
RWE	0.06	0.09	0.07
DAX	0.09	0.07	0.08

	Beta
Commerzbank	1.125
RWE	0.875
DAX	1.000

a) The market value of a portfolio is 100,000 €, consisting of 70% of Commerzbank stocks and 30% of RWE stocks. Compute the value at risk for a holding period of one year (= 250 trading days) and a confidence level of 95% using the variance-covariance approach for
   - the RWE stocks within the portfolio
   - the Commerzbank stocks within the portfolio
   - the whole portfolio

b) Explain possible deviations between the portfolio-value at risk and the sum of single values at risk.

c) Determine the portfolio-value at risk using the diagonal (market) model. Why is the diagonal (market) model preferred over the variance-covariance approach in practice?

Problem 4 (General Questions) 10 points

a) If the slope of the shortfall line decreases, what happens to shortfall probability? What does it mean for Kataoka's criterion (assume that short sales are allowed)?

b) What can you say about discriminative power of a rating function, if the hit rate (hr) equals the false alarm rate (far)? What is the value of area under curve (AUC) and accuracy ratio (AR) in this case?

c) How can the value of a loan under credit risk be illustrated as a portfolio of zero bonds and options? What options will the shareholders exercise in the default and the non-default case?

d) If firm's assets are highly volatile, what does it mean for the put option, value of debt and credit spread according to Merton's model?

Cumulative Standard Normal Distribution

x	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	0.7034	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	0.9131	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	0.9773	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	0.9925	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	0.9959	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	0.9983	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9990	0.9993	0.9995	0.9997	0.9998	0.9998	0.9999	0.9999	1.0000