Winter term 2013/2014 February 11th, 2014

20041: Risk Controlling (Prof. Dr. Reichling)

Please read the following instructions before you start to work on the exam.
1. The exam consists of **five** 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/Downside Risk Criteria) 22 points

a) Describe the shortfall-risk measure for normally distributed portfolio rates of return and the optimal portfolio according to the criteria of Roy, Kataoka and Telser. Sketch the corresponding figures for the general case.

b) Consider the following two investment opportunities:

A		**B**	
Probability	Outcome	Probability	Outcome
0.2	4%	0.1	5%
0.3	6%	0.3	6%
0.4	8%	0.2	7%
0.1	10%	0.3	8%
		0.1	9%

Which single investment opportunity is preferred according to

i) first- and second-order stochastic dominance,
ii) Roy's safety-first criterion, if the target return is 5%,
iii) Kataoka's safety-first criterion, if the shortfall probability is 10%,
iv) Telser's safety-first criterion if the target return is 5% and the shortfall probability is 10%?

Problem 2 (Value at Risk of Stocks) 12 points

Consider the following variance-covariance matrix of multivariate normally distributed annual returns:

	GE	Index
GE	14,1%	7,9%
Index	7,9%	5,6%

a) The market value of a portfolio is 400,000 €, consisting of 40% of GE stocks and 60% of index certificates. Use the variance-covariance approach to compute the value at risk for the

single positions and for the portfolio for a holding period of one year and a confidence level of 95%.

b) Now assume that the correlation coefficient between the GE stock and the index certificates is 1. How does the covariance between the GE stock and the index certificates change? How does the value at risk for the portfolio from a) change? Why?

Problem 3 (Value at Risk of Bonds) 5 points

Consider a zero bond with a face value of 100€ and 10 years to maturity. The 10-years-spot rate is 7.96% and the daily volatility is 0.0963%. What is the bond's value at risk for 1 trading day and a confidence level of 99%?

Problem 4 (Value at Risk of Forwards) 7 points

A stock quotes at 50€ and pays a continuously compounded dividend of 8%. The continuously compounded risk-free rate is 6%.

a) What is the 1-year forward price?

b) The standard deviation of the daily stock price changes is 0.000537 €. What is the forward's value at risk for 1 trading day and a confidence level of 99%?

Problem 5 (Value at Risk of Options) 14 points

a) The delta-normal method is usually used to compute the value at risk of stocks, bonds and forwards. How is the delta-normal method modified if a portfolio contains options?

b) Derive

   i) a linear relation, and

   ii) a quadratic relation

   between the change in the underlying asset's value and the change in the value of an option. Write down the corresponding expressions for the value at risk computation in each case.

Normal distribution — inverse cumulative distribution function

0.50	0.0000	0.60	0.2533	0.70	0.5244	0.80	0.8416	0.90	1.2816	0.99	2.3263
0.51	0.0251	0.61	0.2793	0.71	0.5534	0.81	0.8779	0.91	1.3408	0.991	2.3656
0.52	0.0502	0.62	0.3055	0.72	0.5828	0.82	0.9154	0.92	1.4051	0.992	2.4089
0.53	0.0753	0.63	0.3319	0.73	0.6128	0.83	0.9542	0.93	1.4758	0.993	2.4573
0.54	0.1004	0.64	0.3585	0.74	0.6433	0.84	0.9945	0.94	1.5548	0.994	2.5121
0.55	0.1257	0.65	0.3853	0.75	0.6745	0.85	1.0364	0.95	1.6449	0.995	2.5758
0.56	0.1510	0.66	0.4125	0.76	0.7063	0.86	1.0803	0.96	1.7507	0.996	2.6521
0.57	0.1764	0.67	0.4399	0.77	0.7388	0.87	1.1264	0.97	1.8808	0.997	2.7478
0.58	0.2019	0.68	0.4677	0.78	0.7722	0.88	1.1750	0.975	1.9600	0.998	2.8782
0.59	0.2275	0.69	0.4958	0.79	0.8064	0.89	1.2265	0.98	2.0537	0.999	3.0902