10. 1. 2022
Investment Analysis

Course Credit Exam

To successfully pass the exam, one needs to get at least 37 points out of 56 possible (66%). In the third problem, one does not need to calculate the final number, it is enough to write down a simplified formula, where it is clear which symbols stand for which number.

Presentations

1. What does it mean when a trader calls market Bearish?
2. Describe briefly what it is PoW, can you describe one important difference to PoS?

[6b]

Interest Rate Basics

3. There are quoted prices of the following bonds at the market:

	nominal	time-to-maturity	half-year coupon	market price
A	1000	0.25	0	980
B	1000	0.5	15	970
C	1000	1	20	930

Construct the yield curve from the market quotations, assume continuous compounding.

[9b]

4. Define duration D of an obligation. Show, that the market price of an obligation at time D changes negligibly with small change in the interest rate i. For simplicity, assume that D does not depend on i.

[9b]

Shares

5. Investor Jacob considers investment into a risk-free asset and two other shares. These have returns $\mathbf{r} = (r_0, r_1, r_2)^T$ and variance-covariance matrix $\mathbf{\Sigma}$. Jacob wishes to invest optimally according to the Markowitz model, under the condition that short sales on shares are not permitted (the risk-free asset can be sold). He wants to mminimize risk subject to that the return of his portfolio is atleast μ_0. Formulate the problem, which Jacob needs to solve, write down the Lagrange function and the KKT conditions (optimality, feasibility, complementary slackness conditions) associated with this problem. Do not solve the problem.

[9b]

Utility Functions and Risk Measures

6. Solve the following problem which maximises a utility function of an investor:

$$\begin{aligned} \arg\max_{\mathbf{x}} \quad & \mathbf{E}u(\rho^T \mathbf{x}) \\ \text{s.t.} \quad & \mathbf{1}^T \mathbf{x} = 1, \\ & \mathbf{x} \geq 0, \mathbf{x} \in \mathbf{R}^3, \end{aligned}$$

where $u(z) = \log(z+1)$ a ρ is discrete with two scenarios of the same probability

	A_1	A_2	A_3
S_1	4	2	0
S_2	1	3	5

[16b]

7. Let a random loss of a portfolio be governed by a normal distribution $L \sim \mathcal{N}(\mu, \sigma^2)$, where $\sigma^2 > 0$. Define a risk measure semi-variance and derive its value for such a portfolio.

[7b]