OULUN YLIOPISTO
UNIVERSITY of OULU

YLIOPISTOTENTTILOMAKEPOHJA / UNIVERSITY EXAM TEMPLATE

Koskee tiedekuntia LuTK, OyKKK, KaTK, TTK, TST ja BMTK (Linnanmaan tentit) /
Concerns Faculties SCI, OBS, OMS, TECH, ITEE and BMM (Linnanmaa campus)

Tentin päivämäärä / Date of exam: **2.11.2015**	Tentin kesto tunteina / Exam in hours: **4**
Tiedekunta / Faculty: **OBS / OyKKK**	
Opintojakson koodi, nimi ja tentin numero / The code and the name of the course and number of the exam: **724208A Portfolio Theory (1st exam)**	
Tentaattori(t) / Examiner(s): **Andrew Conlin**	Sisäinen postios. / Internal address **6 OyKKK**
Sallitut apuvälineet / The devices allowed in the exam: ☒ Nelilaskin / Standard calculator ☒ Funktiolaskin / Scientific calculator ☒ Ohjelmoitava laskin / Programmable calculator ☐ Muu materiaali, tarkennettu alla / Other material, specified below:	
Tenttiin vastaaminen / Please answer the questions: ☒ Suomeksi / in Finnish ☒ Englanniksi / in English	
Kysymyspaperi on palautettava / Paper with exam questions must be returned: ☐ Kyllä / Yes ☒ Ei / No	

The exam consists of 10 quantitative questions (2 points each) and 5 short-answer essay questions (4 points each). You need 20 points to pass the exam. There is a formula sheet attached. You may answer in English or Finnish. If you answer in Finnish, use yleiskieli. **WRITE CLEARLY and SHOW YOUR WORK** (no credit for answers if you do not show your work!)

Answer this first!! (write your response on the answer sheet!)
I wish to use my midterm bonus points for this exam: YES NO

Part 1 Quantitative questions

1. Consider a multifactor model with two systematic risk factors F_1 and F_2. The factor risk premiums are 7% and 4% respectively. The risk-free rate is 2%. A well-diversified portfolio X has $\beta_{X,F1} = 0.4$ and $\beta_{X,F2} = 1.8$. What is the expected return on portfolio X?

Questions 2-4 use the following information:

The risk free rate is 1%. There are only two risky assets. The debt fund has an expected return of 7% and $\sigma_D^2 = 0.0169$. The equity fund has an expected return of 13% and $\sigma_E^2 = 0.0625$. The covariance is $Cov(r_D, r_E) = 0.008125$.

2. If you want an expected return of 15% from a portfolio of the two funds (i.e. no long/short position in the risk-free rate), what are the weights?
3. What are the weights in the minimum variance portfolio?
4. If your risk aversion is 6.5 what percentage of your total investment should you put into the optimal risky portfolio?

Questions 5 and 6 are related.
One year ago, you sold short 100 shares of TWTR at a price of $50. The cost of borrowing the shares is 0.25%. The company does not pay a dividend. The maintenance margin is 35%.

5. How high can the price go before you get a margin call?
6. If you covered your short today at $30, what is the percentage return?

7. You have a utility function of the form $U = E(r) - ½A\sigma^2$. The risky portfolio has E(r) = 8% and $\sigma^2 = 0.03077$. The risk-free rate is 1%. If you have 65% of your money invested in the optimal risky portfolio, what is your level of risk aversion?

8. Assume the CAPM model. The risk-free rate is 1.5%. Stock Y has E(r) = 10.6% and $\beta_Y = 1.4$. If Stock Z has $\beta_Z = 2.8$, what is the E(r) for Stock Z?

Questions 9 and 10 are related.
Assume the single index model. The market index has $E(r_M) = 14\%$ and $\sigma_M^2 = 0.0784$. The risk-free rate is 2.5%. Stock G has $\beta_G = 1.1$ and $\sigma_G^2 = 0.1036$. Stock H has $\beta_H = 1.3$ and $\sigma_H^2 = 0.154$.

9. You expect $\alpha_G = 1\%$ and $\alpha_H = 4\%$ What is the weight of each stock in the active portfolio?
10. What is the weight of the active portfolio in the optimal risky portfolio?

Part 2 Write maximum 2 paragraphs (tekstikappale) per question. Write complete ideas; do NOT just list vocabulary words.

1. Leveraged ETFs offer 2x (or even 3x) the daily returns of the SP500. Explain why holding a leveraged ETF for a long period of time may or may not be a good idea.

2. What is the disposition effect and why is it a bad way for investors to behave?

3. What is meant by semi-strong form market efficiency, and what does this imply for investors?

4. Over the last 50 years, gold has provided a lower return than stocks, but gold also has a higher variance than stocks. Why should anyone hold gold in their portfolio?

5. Assume a 1-factor APT model. The risk-free rate is 3%. The expected return on the factor portfolio is $E(r_F) = 11\%$. Portfolio Y has $\beta_Y = 1.5$ and is priced so that $E(r_Y) = 18\%$. Portfolio Z has $\beta_Z = 0.5$ and is priced so that $E(r_Z) = 7\%$. Explain how you can take advantage of this arbitrage opportunity.

Formula Sheet - *Kaavakokoelma*

$$(1+R)=(1+r)(1+i)$$

$$APR=\frac{(1+EAR)^{T}-1}{T}$$

$$\sigma^2 = \sum_s p(s)[r(s) - E(r)]^2, \quad \sigma = \sqrt{\sigma^2}$$

$$Cov(r_i, r_j) = \sum_s p(s)[r_i(s) - E(r_i)][r_j(s) - E(r_j)]$$

$$S = \frac{E(r_P) - r_f}{\sigma_P}$$

$$y^* = \frac{E(r_P) - r_f}{A\sigma_P^2}$$

$$E(r_p) = \sum_{i=1}^{n} w_i E(r_i)$$

$$\sigma_P^2 = \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j Cov(r_i, r_j)$$

$$Cov(r_i, r_j) = \rho_{ij}\sigma_i\sigma_j$$

$$w_{A_{Min}} = \frac{\sigma_B^2 - Cov(r_A, r_B)}{\sigma_A^2 + \sigma_B^2 - 2Cov(r_A, r_B)}; w_{B_{Min}} = 1 - w_{A_{Min}}$$

$$w_A = \frac{[E(r_A)-r_f]\sigma_B^2 - [E(r_B)-r_f]Cov(r_A,r_B)}{[E(r_A)-r_f]\sigma_B^2 + [E(r_B)-r_f]\sigma_A^2 - [E(r_A)-r_f+E(r_B)-r_f]Cov(r_A,r_B)}; w_B = 1 - w_A$$

$$E(R_i) = \alpha_i + \beta_i E(R_M)$$

$$\sigma_{i_{or}P}^2 = \beta_{i_{or}P}^2\sigma_M^2 + \sigma^2(e_{i_{or}P})$$

$$Cov(r_i, r_j) = \beta_i\beta_j\sigma_M^2$$

$$\alpha_P = \sum_{i=1}^{n} w_i \alpha_i; \quad \beta_P = \sum_{i=1}^{n} w_i \beta_i; \quad \sigma^2(e_P) = \sum w_i^2 \sigma^2(e_i)$$

$$w_i^0 = \frac{\alpha_i}{\sigma^2(e_i)} \quad \rightarrow \quad w_i = \frac{w_i^0}{\sum_{i=1}^{n} w_i^0}$$

$$w_A^0 = \frac{\alpha_A / \sigma^2(e_A)}{E(R_M) / \sigma_M^2} \quad \rightarrow \quad w_A^* = \frac{w_A^0}{1 + (1 - \beta_A) w_A^0}$$

$$S_P^2 = S_M^2 + \left[\frac{\alpha_A}{\sigma(e_A)} \right]^2$$

$$E(r_i) = r_f + \beta_i \left[E(r_M) - r_f \right]$$

$$\beta_i = \frac{Cov(r_i, r_M)}{\sigma_M^2}$$

$$E(r_P) = r_f + \beta_{P1} \left[E(r_1) - r_f \right] + \beta_{P2} \left[E(r_2) - r_f \right] + \ldots$$