2018 EXAMINATIONS

Lancaster University

PART II **(SECOND AND FINAL YEAR)**

ACCOUNTING AND FINANCE

AcF 321 **INVESTMENTS**

(2 hours + 15 minutes reading time)

Answer **ALL** questions from Section A (40 marks).

Answer **TWO** questions from Section B (30 + 30 = 60 marks). For each section please write your answers in a separate booklet.

A list of important formulae is included at the end of the examination paper.

The use of standard calculators with scientific, and standard arithmetic and statistical functions, is permitted.

SECTION A (40 Marks)

Section A consists of QUESTIONS 1 and 2. Answer ALL questions.

QUESTION 1

ANSWER ALL PARTS OF THIS QUESTION

You are analyzing the stock of LG Mutual. You have 60 monthly observations of returns on LG, the T-Bill (r_f), and the market factor. You assign a capable and competent assistant to fit the Capital Asset Pricing Model to this data:

$$r_{LG,t} - r_{f,t} = \alpha_{LG} + \beta_{LG}\,(r_{Market,t} - r_{f,t}) + \varepsilon_{LG,t}$$

Your assistant fits the regression, and she gives you this (correct) output from her Excel software:

Regression Statistics						
Multiple R	0.4695					
R Square	0.2204					
Adjusted R Square	0.2070					
Standard Error	0.0524					
Observations	60					
	df	SS	MS	F	Significance F	
Regression	1	0.0450	0.0450	16.39	0.0002	
Residual	58	0.1592	0.0027			
Total	59	0.2043				
	Coefficients	Standard Error	t Stat	Pvalue	Lower 95%	Upper 95%
Intercept	0.0150	0.0068	0.7347	0.4655	-0.0086	0.0185
$r_{Market} - r_f$	1.6185	0.1527	4.0496	0.0002	0.3128	0.9243

REQUIRED:

a. What are the x-variable and y-variable in the regression?
(2 marks)

b. What is the equation of the fitted line?
(3 marks)

c. What is the market beta for LG? Does LG move together with the market?
(5 marks)

d. Is there any strong evidence of mispricing in LG stock?
(4 marks)

e. Is the majority of variance here systematic or unsystematic? Explain your answer.
(4 marks)

QUESTION 2

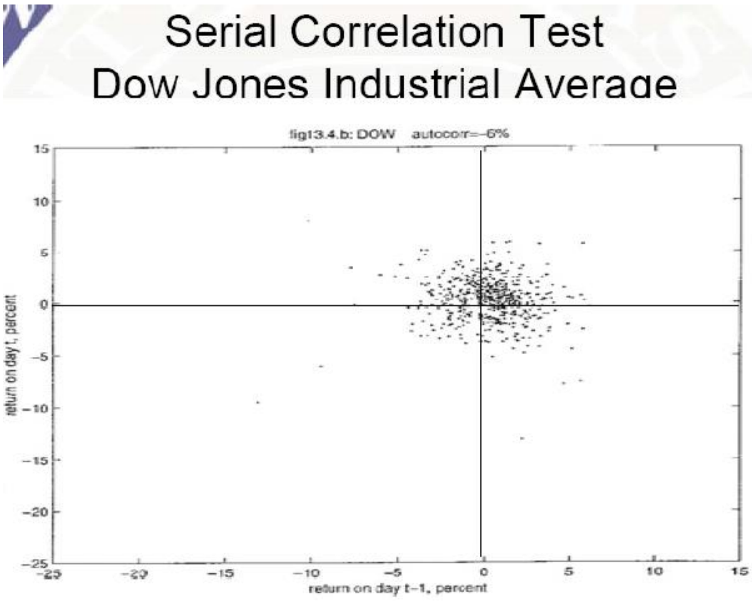
ANSWER ALL PARTS OF THIS QUESTION

a) (i) State the weak form of the efficient market hypothesis (EMH) and also discuss the implication of the weak form of the EMH on return predictability.

(5 marks)

(ii) The figure below shows a scatter plot of daily returns on day t (on the y-axis) against daily returns on day t-1 (on the x-axis) for the Dow Jones Industrial Average Index. The sample period is from January 1990 to February 2017. The serial correlation test indicates that the estimated autocorrelation coefficient is -0.06 with a standard error of 0.12. Is this empirical evidence supportive or contradictory with reference to the weak form of the EMH? Use the empirical evidence provided to support your answer.

(5 marks)



b) What are the three of modern hedge funds' most important characteristics?

(6 marks)

c) Please list the three types of equity based hedge fund trading strategies.

(6 marks)

TOTAL 40 MARKS

SECTION B (60 Marks)

Section B consists of QUESTIONS 3, 4 and 5.

Answer TWO questions out of three in this section.

QUESTION 3

ANSWER ALL PARTS OF THIS QUESTION

Consider a passive mutual fund, an active mutual fund, and a hedge fund. The risk-free interest rate is zero and the mutual funds claim to deliver the following gross returns:

$$r_t^{\text{passive fund before fees}} = r_t^{\text{stock index}} = 6\% + u_t$$
$$r_t^{\text{active fund before fees}} = 1.80\% + 1.1\times r_t^{\text{stock index}} + \varepsilon_t$$

where the error terms u_t and ε_t are independent over time and of each other, have zero means $E(u_t) = E(\varepsilon_t) = 0$, and volatilities of $\sqrt{\text{var}(u_t)} = 15\%$ and $\sqrt{\text{var}(\varepsilon_t)} = 4\%$.

The hedge fund uses the same strategy as the active mutual fund, but implements the strategy as a long-short hedge fund, applying 4 times leverage, generating the following return before fees:

$$r_t^{\text{hedge fund before fees}} = 4\times\left(r_t^{\text{active fund before fees}} - r_t^{\text{stock index}}\right)$$

REQUIRED:

a. What is the active mutual fund's beta (with respect to the stock index)?

(2 marks)

b. What is the hedge fund's beta?

(4 marks)

c. What is the hedge fund's volatility?

(4 marks)

d. What is the hedge fund's expected return before fees?

(4 marks)

e. What is the hedge fund's alpha before fees?

(4 marks)

f. An investor has $40 invested in the active fund and $60 in cash. What investments in the hedge fund, the passive fund and cash (i.e., the risk-free asset) would yield the same market exposure (beta) and same alpha?

(12 marks)

TOTAL 30 MARKS

QUESTION 4

ANSWER ALL PARTS OF THIS QUESTION

a. Suppose that your investment menu has two risky assets (A and B). The expected returns, standard deviations and correlation coefficient are given in the table below.

	$E[r]$	$\sigma[r]$	Correlation
Asset A	0.06	0.12	$\rho(r_A, r_B) = 0.2$
Asset B	0.05	0.18	

REQUIRED:

(i) Find the global minimum variance portfolio, i.e., the fractions of wealth invested in the two risky assets (w_A and w_B). (6 marks)

(ii) Assume that the risk-free rate is $r_f = 0.01$. Find the optimal risky portfolio, i.e., the portfolio weights w_A and w_B that maximize the Sharpe ratio of the portfolio.

(4 marks)

(iii) Calculate Sharpe ratios for the portfolios obtained in (i) and (ii).

(5 marks)

(iv) Suppose that you have the mean-variance utility function

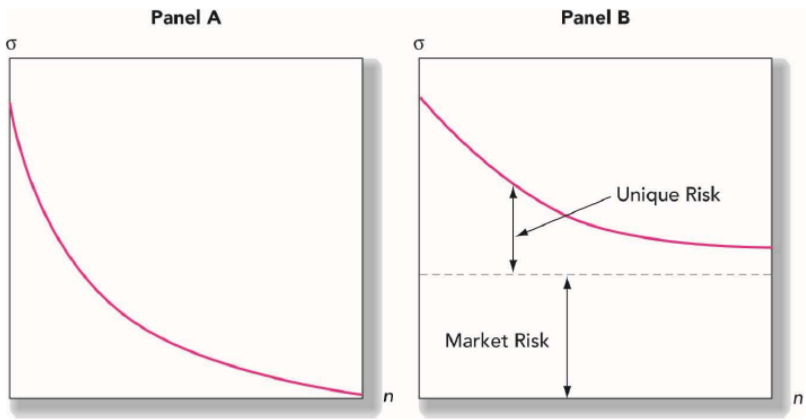
$$U = E[r] - \frac{1}{2} A \sigma_r^2$$

where the risk aversion coefficient $A = 5$. You have access to two assets, one risk-free asset and one risky portfolio. The risk-free rate is 1%. The risky portfolio has an expected return of 5.8% and a standard deviation of 10.9%. Calculate the optimal allocation to the risky portfolio.

(5 marks)

b. With reference to a generic problem of portfolio diversification, explain the meaning of the two plots below. Carefully define what is the variable represented on the x-axis and what is the variable on the y-axis, what is the underlying (simulation) experiment that delivers the two plots, and the difference between the two plots.

(10 marks)



TOTAL 30 MARKS

QUESTION 5

ANSWER ALL PARTS OF THIS QUESTION

Suppose you can invest in three different widely diversified portfolios which are subject to two sources of risk: inflation risk (1st risk factor) and consumption growth risk (2nd risk factor). You have been given the following information about the expected returns and factor betas:

Portfolio	Expected Return (%)	b_{i1}	b_{i2}
A	14	1	0.6
B	12	0.5	0.9
C	9	0.5	0.3

REQUIRED:

a. Use information about portfolios A and C to find the risk-free rate if the APT holds.

(8 marks)

b. Find the two factor risk premiums on inflation (factor 1) and consumption growth (factor 2) respectively according to the APT.

(8 marks)

c. Suppose you create a portfolio (portfolio D) by investing 50% of your wealth in portfolio A, 30% in portfolio B and the remaining 20% in portfolio C. Calculate the expected return and the factor beta of portfolio D.

(8 marks)

d. Suppose there is another portfolio (portfolio E) with the same factor betas as the portfolio you have created in (c) but with an expected return of 13%. If arbitrage opportunities exist, create a strategy that can generate arbitrage profits.

(6 marks)

TOTAL 30 MARKS

Formula Sheet

$$E(r_P) = w_D E(r_D) + w_E E(r_E)$$

$$E(r) = \sum_s p(s) r(s)$$

$$E(r_c) = yE(r_p) + (1-y) r_f$$

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

$$\mathrm{cov}(r_i, r_j) = \sum_s p(s)\left[r_i(s) - E(r_i)\right]\left[r_j(s) - E(r_j)\right]$$

$$\sigma_P^2 = w_D^2 \sigma_D^2 + w_E^2 \sigma_E^2 + 2 w_D w_E Cov(r_D, r_E)$$

$$\rho = \frac{Cov(r_D, r_E)}{\sigma_D \sigma_E}$$

$$MaxU = E(r) - \tfrac{1}{2} A\sigma^2 = r_f + y[E(r_p) - r_f] - \tfrac{1}{2} A y^2 \sigma_P^2$$

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

$$w_{Min}(D) = \frac{\sigma_E^2 - \mathrm{cov}(r_D, r_E)}{\sigma_E^2 + \sigma_D^2 - 2\,\mathrm{cov}(r_D, r_E)}$$

$$w_{Min}(E) = 1 - w_{Min}(D)$$

$$w_D = \frac{\left(E(r_D) - r_f\right)\sigma_E^2 - \left(E(r_E) - r_f\right)Cov(r_D, r_E)}{\left(E(r_D) - r_f\right)\sigma_E^2 + \left(E(r_E) - r_f\right)\sigma_D^2 - \left(E(r_D) - r_f + E(r_E) - r_f\right)Cov(r_D, r_E)}$$

$$w_E = 1 - w_D$$

$$\frac{E[r_M] - r_f}{\sigma_M^2}$$

$$\frac{E(r_M) - r_f}{\sigma_M}$$

$$\frac{E(r_i) - r_f}{\sigma_i}$$

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

$$\beta_i = \frac{\mathrm{cov}(r_i, r_M)}{\sigma_M^2} = \frac{\rho_{i,M}\sigma_i}{\sigma_M}$$

$$R^2 = \rho_{i,M}^2$$

$$r_i = E(r_i) + e_i$$

Please turn over

$$\sigma_i^2 = \sigma_m^2 + \sigma^2(e_i)$$

$$Cov(r_i, r_j) = Cov(m + e_i, m + e_j) = \sigma_m^2$$

$$r_i = E(r_i) + \beta_i m + e_i$$

$$\sigma_i^2 = \beta_i^2 \sigma_m^2 + \sigma^2(e_i)$$

$$Cov(r_i, r_j) = Cov(\beta_i m + e_i, \beta_j m + e_j) = \beta_i \beta_j \sigma_m^2$$

$$R_i = r_i - r_f$$

$$R_M = r_M - r_f$$

$$R_i(t) = \alpha_i + \beta_i R_M(t) + e_i(t)$$

$$R_P = \alpha_P + \beta_P R_M + e_P$$

$$\beta_P = 1/N \sum_{i=1}^{N} \beta_i$$

$$\alpha_P = 1/N \sum_{i=1}^{N} \alpha_i$$

$$e_P = 1/N \sum_{i=1}^{N} e_i$$

$$\sigma_P^2 = \beta_P^2 \sigma_M^2 + \sigma^2(e_P)$$

$$\sigma^2(e_P) = \frac{1}{n} \overline{\sigma}^2(e_i)$$

$$M^2 = [1 - \frac{\sigma_M}{\sigma_p}]\bar{r}_F + \frac{\sigma_M}{\sigma_p}\bar{r}_p - \bar{r}_M$$

$$IR = \frac{\alpha_P}{\sigma(e_P)}$$

$$\alpha_P = \overline{r}_P - \overline{r}_f - \beta_P\left(\overline{r}_M - \overline{r}_f\right)$$

$$= \overline{r}_P - \left[\overline{r}_f + \beta_P\left(\overline{r}_M - \overline{r}_f\right)\right]$$

$$T = \frac{\overline{r_p} - \overline{r_f}}{\beta_P}$$

END OF PAPER