

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

B. COMM (HONOURS) DEGREE IN ACTUARIAL SCIENCE

FINANCIAL ECONOMICS : CIN 4115

NOVEMBER/DECEMBER 2004 FIRST SEMESTER EXAMINATION

DURATION : 2 HOURS

INSTRUCTIONS TO CANDIDATES

1. Attempt all questions
 2. You must not start writing your answers in the booklet until instructed to do so by the invigilator.
 3. In addition to this question paper, you require an electronic calculator (non-programmable)
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1. An investor can choose between 2 investments A and B.

Investment A – the rate of return is distributed uniformly between 4% and 10%

Investment B – The rate of return can take only discrete values with the following probabilities

Probability	B
$\frac{1}{5}$	12%
$\frac{1}{5}$	10%
$\frac{1}{5}$	8%
$\frac{2}{5}$	3%

For each investment calculate

- (a) Mean [2 marks]
- (b) Variance [2 marks]
- (c) Semi-variance [4 marks]
- (d) The shortfall probability with level of 6% [6 marks]
- (e) The mean shortfall with level of 5% [6 marks]

[Total 20 marks]

2. An investor makes his investment decisions based on the log utility function

$U(w) = \ln w$, $w \geq 0$ where w denotes his wealth at the end of the period of investment

- (a) Show that this investor is non-satiated and risk-averse. **[6 marks]**
- (b) The investor above has initial wealth of \$20 000. He could invest all his wealth in cash for one year at a guaranteed rate of return of 5% per annum. Alternatively he could invest entirely in shares which over the year have equal probability of earning a rate of return of 10% per annum or of 2% per annum.

Determine whether the investor should choose cash or shares.

[8 marks]

[Total: 14 marks]

3. Consider two risky assets A and B with returns (x) having cumulative probability distribution functions given by:

$$F_A(x) = x \quad \text{and} \quad F_B(x) = \sqrt{x} \quad \text{where} \quad 0 \leq x \leq 1$$

Verify that A dominates B on the basis of the third order stochastic dominance.

[9 marks]

4. Assume the CAPM holds

- (a) (i) What constitutes the market portfolio in the CAPM? **[4 marks]**
- (ii) The valuation interest rate in an asset liability model needs to be consistent with the asset weights. Given that the government state that the valuation interest rate is $(5W_g + 3W_e)\%$, where W_g and W_e are the weights in gilts and equities respectively. Our model calculates that the assets at time t are \$100 million. The model calculates that a benefit of \$120 million must be paid at time t + 5. What proportion must we invest in gilts so that the value of the asset at time t are at least as high as the value of the liabilities. (There are no premiums, expenses or mortality) **[7 marks]**
- (iii) Give an interpretation for the terms in the equation of the Capital Market Line. **[4 marks]**
- (b) Assume the beta of a security is either
- (i) $\beta = 0$ or
- (ii) $\beta < 0$

Compare the expected return of this security in both cases with the risk free rate of return and give an explanation of your observations.

[8 marks]

[Total 23 marks]

5. Explain the three forms of efficient market hypothesis (EMH) **[9 marks]**
6. An investor chooses to invest in equities from two counters Boc and Naschco. Boc equities have an expected return of 5%, with standard deviation 15%. Naschco equities are more risky, their expected returned is 10% with standard deviation 25%. The correlation coefficient of the two equity markets is 0.3.
- (i) Given that the investor has α invested in Boc shares and $1 - \alpha$ invested in Naschco shares, state equations for the expected return and standard deviation for the investor's portfolio. **[8 marks]**
- (ii) The investor is allowed to invest both long and short in Boc and Naschco equities. Prove that the investor's opportunity set in $\bar{R} - \sigma$ space is a hyperbola with equation $\sigma^2 = a\bar{R}^2 + b\bar{R} + c$
- Find the values for a, b and c. **[6 marks]**
[Total 14 marks]
7. A risky security, A has expected return 13% and variance of return 100 %%. You are advised that the risk-free rate of return is 4%.
- (i) Given that A is an efficient portfolio, derive the equation for the capital market line. **[6 marks]**
- (ii) The expected return on the market (M) is 9%. Using your result in part (i) above calculate the variance of the return on the market. **[5 marks]**
[Total 11 marks]

END OF EXAMINATION PAPER