CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF MASTER OF SCIENCE IN APPLIED STATISTICS

MATH 859: FINANCIAL TIME SERIES & RISK MANAGEMENT

STREAMS: **TIME: 3 HOURS**

DAY/DATE: THURSDAY 14/12/2017 **8.30 A.M – 10.30 A.M**

INSTRUCTIONS:

- **Answer any three questions**

1. (a) Outline 5 properties of return series stylized fact in financial time series and risk management. [5marks]

   (b) Suppose there are two assets of type A and type B. If type A is worth 10 million shillings with volatility of 10% per year and asset B is worth 40 million shillings with volatility of 8% per year , Calculate the VaR over the next 16 days with probability of 0.99 for

   (i) Type A [5marks]

   (ii) Type B [5marks]

   (iii) Combined assets if the correlation between assets A and B is 0.3. [3marks]

   (iv) What is the benefit of holding a diversified portfolio of assets A and B. [2marks]

2. (a) Suppose that financial time series model is defined by

   $X_t = \mu + \alpha X_{t-1} + e_t$. where e_t is ii$\sim(0, \sigma^2)$

   Find the mean and variance of X_t. [9marks]

   (b) Let $X_t = \sqrt{\beta_0 + \beta_1 X_{t-1}^2}\, e_t^2$ be stationary ARCH (I) with

E (x^4) = C < ∞ and e_t being ii~ N(0,1) show that

E (X_t^4) = $\frac{3\,\beta^2\,(1+\beta_1)}{(1-3\,\beta_1^2)(\,1-\beta_1)}$ [11marks]

3. (a) Define generalized autoregressive conditional heterosietable (G ARCH) process of order (q, p). [4marks]

(b) Find the stationary variance for GARCH (1, 2) with $0 < \propto < 1$ [16marks]

4. (a) Outline 4 properties of coherent risk that must be fulfilled in risk management. [4marks]

(b) Given $\partial_t = \sqrt{\beta_0} + \beta_1 X_{t-1}^2$ for T = 1 of ARCH (I) . Estimate $\beta_0\ and\ \beta_1$ using ols or MLE method. [6marks]

(c) Consider a random variable X with p.d.f

f(x) = $\begin{cases} e^{-x}, & x > 0 \\ 0, & elsewhere \end{cases}$

find the quartile of x where 0 is

(i) 0.95 [5marks]
(ii) 0.99 [5marks]

5. (a) Outline 5 limitation of VaR in risk management. [5marks]

(b) The generalized pareto distinguish function defined .

$G_\delta, \beta(\mathbf{z}) = \frac{1}{\beta}\left[1 + \frac{\hat{\delta}}{\beta}\mathbf{z}\right]^{-\frac{1}{\delta}} - 1$

Find $\hat{\beta}$ and $\hat{\delta}$ using MLE. [8marks]

(c) Let $X_t = \mu + \propto X_{t-1} + e_t$ where $e_t \sim$ iid ($0, \partial^2$) and independent of X_t. Find a h steps forecast given X_t, X_t, X_{t-2}……. [7marks]
