Reg. No. | | | | | | | | | |

STS 554

IV Semester M.Sc. Degree Examination, September/October 2022
STATISTICS
Financial Time Series

Time : 3 Hours   Max. Marks : 70

Instructions : *1) Question No.* ***1*** *is* ***compulsory****.*
2) Answer ***any four*** *questions from the* ***remaining****.*

1. Answer **any six** subdivisions from the following. **(6×3=18)**

   a) Explain the special features of financial time series. How it is different from classical time series ?

   b) Explain the terms :
      i) Continuously compounded multiperiod return
      ii) Portfolio return
      iii) Dividend payment.

   c) Define sample skewness and sample kurtosis of the return. Give the test statistics for
      i) testing skewness of return is zero
      ii) testing excess kurtosis of return is zero.

   d) Define sample autocorrelation function (ACF) of a stationary time series. Obtain autocorrelation function of the time series $X_t = 0.9X_{t-1} + \varepsilon_t$. Is it stationary ? Justify.

   e) Explain the test procedure for detecting unit root in a time series.

   f) Describe seasonal integrated autoregressive moving average model.

   g) Define volatility and state its properties.

   h) Explain co integration and error correction models.

2. a) Define ARCH(p) model. Explain a test procedure for testing the ARCH effect.

   b) Let Y_t follows ARCH(1) process. Show that $\{Y_t\}$ is uncorrelated. Obtain ACF of Y_t^2. Show that marginal distribution of $\{Y_t\}$ is heavy tailed.

   c) Obtain the Yule-Walker equation for the ARCH(p) process. **(4+5+4)**

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3. a) Define moving average process of order q. Obtain its variance and auto covariance function.

   b) Let X_t follows AR(1) and $\overline{X}_n = \frac{\sum_{t=1}^{n} X_t}{n}$ find $Var(\overline{X}_n)$.

   c) Suppose that the daily log return of a security follows the model rt = 0.01 + 0.2rt – 2 + at, where {at} is a Gaussian white noise series with mean zero and variance 0.02. What are the mean and variance of the return series rt ? Compute the lag-1 and lag-2 autocorrelations of rt. **(5+3+5)**

4. a) Explain Yule-Walker method of estimation for an AR(p) model.

   b) Write the model in backward shift operator $X_t = 1.5X_{t-1} - 0.6X_{t-2} + \varepsilon_t$. Examine for stationary. Obtain the Yule-Walker equations for this model and solve these equations to obtain ρ_1 and ρ_2. **(5+8)**

5. a) Define GARCH (p, q) model for the return series. Obtain the variance and kurtosis of return series which follows GARCH(1 1).

   b) Obtain the maximum likelihood estimates of parameters of ARCH(1) process. **(7+6)**

6. a) Define Exponential GARCH and GARCH in mean models. State elementary properties of these models.

   b) Explain how GARCH(1 1) is related to ARMA(1 1) process. Whether writing GARCH as ARMA solve the problem of estimation. Explain.

   c) Explain the order determination procedure of classical financial time series models. **(5+4+4)**

7. a) Explain residual analysis in time series modeling. Explain the related tests based on residuals.

   b) Obtain h-step ahead forecast of GARCH(1, 2) process.

   c) Explain the steps involved in building a financial time series model. **(4+5+4)**

8. a) Obtain the autocorrelation function of GARCH(1 1) process.

   b) Obtain Explicit expression for ACF of ARMA(1 1) process.

   c) Derive the L-step ahead forecast equation of ARCH (p) process. **(4+4+5)**
