

Economics 706 Preliminary Examination

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Do all questions, providing detail and discussion as appropriate. That is, don't just state "answers". WRITE CAREFULLY AND CLEARLY. Good luck!

(1) Consider a univariate covariance stationary series y with spectral density $f_y(\omega)$. Show that $f_y(\omega)$ is (1) symmetric around the origin, (2) real-valued, (3) non-negative, (4) 2π -periodic, (5) related to the spectral density of white noise, and (6) proportional to the variance of \bar{y} . In what sense does $f_y(\omega)$ provide a decomposition of the total variation in y ?

(2) Consider a multivariate covariance stationary series y . Characterize in detail the relationships among (1) the Wold-Wiener-Kolmogorov innovations, (2) the transition and measurement shocks in a state-space representation, and (3) the Kalman filter optimal 1-step-ahead prediction errors, in both small and large samples.

(3) Consider the Dickey-Fuller studentized test statistic for a unit root in the simple AR(1) process, $y_t = \rho y_{t-1} + \varepsilon_t$, where ε is distributed as standard normal and $y_0 = 0$. Describe in detail how you would use Monte Carlo simulation methods to (1) estimate (tabulate) the null distribution of the test statistic for a variety of sample sizes T , and (2) estimate the power function of the test for $\rho \in [0, 1]$ and $T \in [10, 1000]$. Pay attention to variance-reduction methods such as common random numbers and response surfaces.