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MTH517/517A: Time Series Analysis
Quiz #1; Full Marks-20

Let $\{X_t\}$ be a time series given by $X_t = \alpha + \beta t + S_t + Y_t$; where, α and β are real constants, S_t is a seasonal component with period 6 and $Y_t = \varepsilon_t - \varepsilon_{t-1}$; $\{\varepsilon_t\}$ is a sequence of independent and identically distributed $N(0, \sigma^2)$ random variables.

Prove or disprove the following statements:

- **(a)** $Cov(X_t, X_{t+h}) = 0; \forall |h| \geq 2$
- **(b)** $\{X_t\}$ is covariance stationary
- **(c)** $\{X_t\}$ is a Gaussian time series
- **(d)** $\{\nabla X_t\}$ is covariance stationary
- **(e)** $Cov(\nabla_6 X_t, \nabla_6 X_{t+h}) = 0; h = \pm 2, \pm 3, \pm 4$
- **(f)** $\{\nabla_6 X_t\}$ is covariance stationary
- **(g)** $\{\nabla_6 X_t\}$ is strict stationary
- **(h)** $\{\nabla_6^2 X_t\}$ is an MA process

$Y_t = \varepsilon_t - \varepsilon_{t-1}$

$X_t = \alpha + \beta t + S_t + Y_t$

$\varepsilon_t \sim N(0, \sigma^2$

$S_t = S_{t+6}$

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