Stationarity and Linear filters

Quiz, 6 questions

1 point

1.
Does any stochastic process with the covariance function $K(t,s) = sin(\lambda(t-s))$ exist?

- Yes
- No

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1 point

2.
Let Y_n be a stochastic process which is defined as follows:

$Y_{n+1} = \alpha Y_n + X_n, n = 0, 1, \ldots$ Assume $Y_0 = 0$, $|\alpha| < 1$ and X_n is a sequence of i.i.d. standard normal random random variables for $n = 0, 1, 2, \ldots$ Decide whether Y_n is stationary and find its mean and variance:

- Y_n is non-stationary, $\mathbb{E}Y_n = 0$, $VarY_n = \dfrac{1}{1-\alpha^2}$
- Y_n is stationary, $\mathbb{E}Y_n = 0$, $VarY_n = \dfrac{1}{1-\alpha^2}$
- Y_n is non-stationary, $\mathbb{E}Y_n = 0$, $VarY_n = \alpha^2 + 1 + 2K(Y_n, X_n)$
- Y_n is stationary, $\mathbb{E}Y_n = 0$, $VarY_n = \alpha^2 + 1$
- none of above

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1 point

3.

Let W_t be a Brownian Motion. Is $X_t = (1-t)W_{t/(1-t)}$ a stationary process?

- [ ] none of above
- [ ] X_t is weakly stationary process
- [ ] X_t is strictly stationary process

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1 point

4.

Let W_t be a Brownian Motion and $h > 0$ is a fixed number. Find a covariance function of a process $X_t = W_{t+h} - W_t$:

- [ ] $K(t, s) = 0 \, \forall t, s$
- [ ] $K(t,s) = \begin{cases} h - |t-s|, & if|t-s| \leq h \\ 0, & if|t-s| > h \end{cases}$
- [ ] $K(t,s) = \begin{cases} min(t,s), & if|t-s| \leq h \\ 0, & if|t-s| > h \end{cases}$
- [ ] none of above

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1 point

5.

Let X_t is a process with independent and stationary increments. Moreover, $\mathbb{E}X_t = 0$ and $\mathbb{E}X_t^2 < \infty$. Is $Y_t = X_{t+h} - X_t$ is a wide-sense stationary process $\forall h > 0$?

- Yes
- No
- Additional information on X_t is required

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1 point

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6.

Let X_t be a wide-sense stationary process with autocovariance function γ, which equals to $\gamma(0) = 2$, $\gamma(1) = \gamma(-1) = 1$ and $\gamma(n) = 0$ for all other n.
Find a spectral density $g_X(u)$ of this process:

- [ ] $g_X(u) = \frac{1 + cosu}{2\pi}$
- [ ] $g_X(u) = \frac{1 + 2cosu}{\pi}$
- [ ] None of above
- [ ] $g_X(u) = \frac{1 + 2cosu}{2\pi}$
- [ ] $g_X(u) = \frac{1 + cosu}{\pi}$

- [ ] I, **Mark R. Lytell**, understand that submitting work that isn't my own may result in permanent failure of this course or deactivation of my Coursera account.

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