Lévy processes

Quiz, 6 questions

1 point

1.
$X_t = bt + \sigma W_t + cN_t$, where W_t is a Brownian Motion, N_t is a Poisson process with intensity λ, and W_t, N_t are independent; $b, c \in \mathbb{R}$, $\sigma \geq 0$.

Find a characteristic function of this process:

- $exp\{iub + \frac{\lambda(e^{icu} - 1)}{t} - \frac{(\sigma u)^2}{2}\}$
- $iub + \frac{\lambda(e^{icu} - 1)}{t} - \frac{(\sigma u)^2}{2}$
- $exp\{iubt + \lambda t(e^{icu} - 1) - \frac{t(\sigma u)^2}{2}\}$
- none of above

1 point

2.
Consider the previous process $X_t = bt + \sigma W_t + cN_t$, where W_t is a Brownian Motion, N_t is a Poisson process with intensity λ, and W_t, N_t are independent; $b, c \in \mathbb{R}$, $\sigma \geq 0$.

What are the mean, variance and covariance function of this process?

- $\mathbb{E}[X_t] = t(b + c\lambda), Var(X_t) = t(\sigma^2 + c\lambda), K(t, s) = 0$
- $\mathbb{E}[X_t] = t(b + c\lambda), Var(X_t) = t(\sigma^2 + c^2\lambda),$ $K(t, s) = (c^2\lambda + \sigma^2)\min(t, s)$
- $\mathbb{E}[X_t] = tb, Var(X_t) = t(\sigma^2 + c^2\lambda), K(t, s) = \lambda\min(t, s)$
- none of above

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3.

Consider the previous process $X_t = bt + \sigma W_t + cN_t$, where W_t is a Brownian Motion, N_t is a Poisson process with intensity λ and W_t, N_t are independent; $b, c \in \mathbb{R}$, $\sigma \geq 0$. Denote the Lévy measure of this process by ν.

What is measure ν of a Borel set B ?

- $\nu(B) = \lambda$, if $1 \in B$ and 0 otherwise
- $\nu(B) = \lambda \mathbb{P}\{\xi_1 \in B\}$, if $\xi_1 \in B$ and 0 otherwise
- $\nu(B) = bt + \lambda$, if $1 \in B$ and 0 otherwise
- none of above

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1 point

4.

Let X_t be a Levy process. What is the correct expression of $Var(X_t)$ in terms of characteristic exponent ψ?

- none of above
- $Var(X_t) = -t\psi''(0) - t^2\psi'(0)$
- $Var(X_t) = -t\psi''(0)$
- $Var(X_t) = -t\psi''(0) - t^2(\psi'(0))^2$

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1 point

5.

Let X_t be a Lévy process. Assuming that $X_1 \sim N(0, 1)$, find the mean and the variance of X_t:

- none of above
- $\mathbb{E}[X_t] = t, Var(X_t) = ts$
- $\mathbb{E}[X_t] = 0, Var(X_t) = \min(t, s)$

$\mathbb{E}[X_t] = 0, Var(X_t) = ts$

$\mathbb{E}[X_t] = t, Var(X_t) = t\min(t, s)$

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6.
Let $X_t = bt + N_t$, where N_t is a Poisson Process with intensity λ and $b \in \mathbb{R}$. Find the Lévy triplet of this process.

- $(b + \lambda, 0, \nu)$, where $\nu(B) = \lambda \mathbb{I}\{1 \in B\}$ for any Borel set B.
- (b, λ, ν), where $\nu(B) = \mathbb{I}\{0 \in B\}$ for any Borel set B
- none of above
- $(b, \lambda^2, 0)$
- $(\lambda, \lambda^2, \nu)$, where $\nu(B) = \lambda \mathbb{I}\{1 \in B\}$ for any Borel set B.

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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