

Unit 12 - Week 10: Introductory Stochastic Calculus (Part 2)

Course outline

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Week 0

Week 1: Introduction to Financial Markets and Instruments

Week 2: Time Value of Money and Riskfree Assets

Week 3: Modern Portfolio Theory (Part 1)

Week 4: Modern Portfolio Theory (Part 2)

Week 5: Fundamentals of Derivatives

Week 6: Derivative pricing by replication in binomial model

Week 7: Risk-Neutral Pricing in Discrete-Time (Part 1)

Week 8: Risk-Neutral Pricing in Discrete-Time (Part 2)

Week 9: Introductory Stochastic Calculus (Part 1)

Week 10: Introductory Stochastic Calculus (Part 2)

Lec 28: Itô Integral and its Properties

Lec 29: Itô Formula, Itô Processes

Lec 30: Multivariable Stochastic Calculus, Stochastic Differential Equations

Quiz : Assignment 10

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Week 11: Risk-Neutral Pricing in Continuous-Time (Part 1)

Week 12: Risk-Neutral Pricing in Continuous-Time (Part 2)

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Live Session

Assignment 10

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2019-10-09, 23:59 IST.

1) Let $[x]$, for $x \in [0, \infty)$, denote the greatest integer less than or equal to x .

Then, which of the following functions (defined on $[0, \infty)$) can represent a sample path of a simple process?

$$f_1(x) = [x]$$

$$f_2(x) = [x]/2$$

$$f_3(x) = [x]/x$$

$$f_4(x) = e^{[x]}$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$f_1(x) = [x]$$

$$f_2(x) = [x]/2$$

$$f_4(x) = e^{[x]}$$

1 point

2)

If the stochastic process $\{X_t\}$ satisfies $dX_t = -aX_t dt + \sigma dW_t$, $X_0 = 0$, where a, σ are positive constants, and $\{W_t\}$ is a Brownian motion, then which of the following is/are true?

$$X_t \sim \mathcal{N}\left(0, \frac{\sigma}{2a}(e^{2at} - 1)\right)$$

$$X_t \sim \mathcal{N}\left(0, \frac{\sigma^2}{2a}(1 - e^{-2at})\right)$$

X_t can take negative values.

$$\lim_{t \rightarrow \infty} E(X_t) = \frac{1}{a}$$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$$X_t \sim \mathcal{N}\left(0, \frac{\sigma^2}{2a}(1 - e^{-2at})\right)$$

X_t can take negative values.

2 points

3) State whether the following statement is TRUE or FALSE:

If $I_t = \int_0^t s dW_s$, then the quadratic variation of I_t equals the variance of I_t .

 TRUE

 FALSE

No, the answer is incorrect.

Score: 0

Accepted Answers:

TRUE

1 point

4) State whether the following statement is TRUE or FALSE:

The quadratic variation of an Ito process is always equal to the quadratic variation of the corresponding Ito integral process.

 TRUE

 FALSE

No, the answer is incorrect.

Score: 0

Accepted Answers:

TRUE

1 point

5) Let $I_t = \int_0^t X_s dW_s$, where X_t takes the value 1 for $0 \leq t < 2$, takes the value 3 for $2 \leq t \leq 3$ and takes the value 0 otherwise.

Then, which of the following is/are true?

$$I_3 \sim \mathcal{N}(0, 6)$$

I_1 follows a standard normal distribution.

The distribution of I_2 can not be determined.

$\{I_t\}_{t \geq 0}$ is a martingale.

No, the answer is incorrect.

Score: 0

Accepted Answers:

I_1 follows a standard normal distribution.

$\{I_t\}_{t \geq 0}$ is a martingale.

2 points

6) State whether the following statement is TRUE or FALSE:

The process $\{W_t^3 - tW_t\}$ is a martingale.

 TRUE

 FALSE

No, the answer is incorrect.

Score: 0

Accepted Answers:

FALSE

1 point

7) State whether the following statement is TRUE or FALSE:

For $X_t = tW_t$ and $Y_t = e^{W_t}$, we have that $d(X_t Y_t) = e^{W_t} \left[\frac{tW_t}{2} + W_t + t \right] dt + te^{W_t} dW_t$.

 TRUE

 FALSE

No, the answer is incorrect.

Score: 0

Accepted Answers:

FALSE

2 points