

第一部分：回答下列 6 題單選題，每題 10 分。作答於答案卡上。

第二部分(填充題)：第 7 ~ 10 題，請於制式試卷(答案本)上作答，“需列出”計算過程

第一部分：單選題

1. Let $\tilde{y} = e^{\tilde{x}}$, where \tilde{x} is normally distributed with mean μ and variance σ^2 .

What is the value of $\frac{\text{stdev}(\tilde{y})}{E[\tilde{y}]}$?

- a. $\sqrt{e^{\sigma^2} - 1}$ b. $\sqrt{e^{2\sigma} - 1}$ c. $\sqrt{2e^{2\sigma} - 1}$ d. $\sqrt{e^{2\sigma} - 2}$

[2, 3, 4] Suppose there are three possible states of the world which are equally likely, so $\Omega = \{\omega_1, \omega_2, \omega_3\}$ with $\mathbb{P}(\{\omega_1\}) = \mathbb{P}(\{\omega_2\}) = \mathbb{P}(\{\omega_3\}) = 1/3$. Let \mathcal{G} be the collection of all subsets of Ω :

$$\mathcal{G} = \{\emptyset, \{\omega_1\}, \{\omega_2\}, \{\omega_3\}, \{\omega_1, \omega_2\}, \{\omega_1, \omega_3\}, \{\omega_2, \omega_3\}, \Omega\}.$$

Let \tilde{x} and \tilde{y} be random variables, and set $a_i = \tilde{x}(\omega_i)$ for $i = 1, 2, 3$. Assume no two of the a_i are the same. Suppose $\tilde{y}(\omega_1) = b_1$ and $\tilde{y}(\omega_2) = \tilde{y}(\omega_3) = b_2 \neq b_1$.

2. Which of the following statement is not correct?

- a. $\text{prob}(\tilde{x} = a_1 | \tilde{y} = b_1) = 1$
 b. $\text{prob}(\tilde{x} = a_2 | \tilde{y} = b_1) = 0$
 c. $\text{prob}(\tilde{x} = a_2 | \tilde{y} = b_2) = 1$
 d. $\text{prob}(\tilde{x} = a_1 | \tilde{y} = b_2) = 0$

3. Which of the following statement is correct?

- a. $E(\tilde{x} | \tilde{y} = b_1) = a_1$
 b. $E(\tilde{x} | \tilde{y} = b_2) = a_2$
 c. $E(\tilde{x} | \tilde{y} = b_1) = (a_1 + a_2)/2$
 d. $E(\tilde{x} | \tilde{y} = b_2) = (a_1 + a_3)/2$

4. What is the σ -field generated by \tilde{y} ?

- a. $\{\emptyset, \{\omega_1\}, \{\omega_2\}, \{\omega_3\}, \{\omega_1, \omega_2\}, \{\omega_1, \omega_3\}, \{\omega_2, \omega_3\}, \Omega\}$
 b. $\{\emptyset, \{\omega_1\}, \{\omega_2\}, \{\omega_3\}, \Omega\}$
 c. $\{\emptyset, \{\omega_1\}, \{\omega_2, \omega_3\}, \Omega\}$

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d. $\{\emptyset, \{\omega_1, \omega_2\}, \{\omega_3\}, \Omega\}$

5. Assume X is an Itô process. Which of the following statement is not correct?

(a) Define $Y_t = e^{Xt}$, then $\frac{dY}{Y} = dX + \frac{1}{2}(dX)^2$

(b) Assume X is strictly positive. Define $Y_t = \log X_t$, then $dY = \frac{dX}{X} - \frac{1}{2}\left(\frac{dX}{X}\right)^2$

(c) Assume X is strictly positive. Define $Y_t = X_t^{-\lambda}$ for a constant λ ,

then $\frac{dY}{Y} = -\lambda \frac{dX}{X} + \frac{\lambda(1+\lambda)}{2}\left(\frac{dX}{X}\right)^2$

(d) Assume S is a geometric Brownian motion: $\frac{dS}{S} = \mu dt + \sigma dB$, for constants μ

and σ and a Brownian motion B , then $\text{var}_t\left(\frac{S_{t+1}}{S_t}\right) = e^{2\mu}(e^{2\sigma} - 1)$

6. Which of the following statement is not correct

(a) Assume $X_t = \theta - e^{-\kappa t}(\theta - X_0) + \sigma \int_0^t e^{-\kappa(t-s)} dB_s$ for a Brownian motion B and constants θ and κ , then $dX = -\kappa X dt + \sigma dB$

(b) Assume $dX = -\kappa X dt + \sigma dB$ for constants κ and σ . Set $Y = X^2$, then

$dY = \hat{\kappa}(\hat{\theta} - Y)dt + \hat{\sigma}\sqrt{Y}dB$, for constants $\hat{\kappa}$, $\hat{\theta}$ and $\hat{\sigma}$.

(c) Let B be a Brownian motion. Define $Y_t = B_t^2 - t$, then Y is a martingale.

(d) Let $dM = \theta dB$ for a Brownian motion B , then $M_t^2 - \int_0^t (dM_s)^2$ is a local martingale.

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第二部分：填充題（共四十分。每題 10 分）

注意事項：

※※所有問題均請詳列計算過程，若只有答案將不予計分※※

※※填充題題型請至少計算至小數點後第二位※※

※※答案請於答案卷(本)上標示清楚，如 ANS: XXXXXX ※※

※※一律作答於所附之考試答案卷(本)上。若於試題卷上作答者，將不予計分
※※

(7)	(7)之答案與計算過程
(8)	(8)之答案與計算過程
(9)	(9)之答案與計算過程
(10)	(10)之答案與計算過程

7. Your firm is planning to invest in a new electrostatic power generation system that is all equity financed. Hoothoot Inc. is a firm that specializes in this business. Hoothoot has a stock price of \$30 per share with 15 million shares outstanding. Hoothoot's equity beta is 2.11. It also has \$350 million in debt outstanding with a debt beta of 0.03. If the risk-free rate is 2.5%, and the market risk premium is 11%, then your estimate of your cost of capital for electrostatic power generators is close to: ANS: _____

8. You expect that MIT Enterprise will have earnings per share of \$2.8 for the coming year. MIT plans to retain all of its earnings for the next three years. For the subsequent two years, the firm plans on retaining 25% of its earnings. It will then retain only 10% of its earnings from that point forward. Retained earnings will be invested in projects with an expected return of 12% per year. If MIT's equity cost of capital is 9%, then the price of a share of MIT's stock is close to: ANS: _____

9. After graduation, you plan to work for Glalie Corp. for 12 years and then start your own business. You expect to save and deposit \$5,000 a year for the first 6 years and \$19,000 annually for the following 6 years. The first deposit will be made a year from today. In addition, your aunt just gave you a \$60,000 graduation gift which you will deposit immediately. If the account earns 8.5% compounded annually, how much will you have when you start your business 12 years from now? ANS: _____

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10. Tesla Food Company is considering a new salsa whose data are shown below. The equipment to be used would be depreciated by the straight-line method over its 3-year life and would have a zero salvage value, and no change in net operating working capital would be required. Revenues and other operating costs are expected to be constant over the project's 3-year life. However, this project would compete with other Tesla products and would reduce their pre-tax annual cash flows. What is the project's NPV? ANS:

WACC	11%
Pre-tax cash flow reduction for other products (cannibalization)	\$6,000
Investment cost (depreciable basis)	\$99,000
Annual sales revenues	\$70,000
Annual operating costs (excl. depreciation)	\$20,000
Tax rate	40%

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