

1. ERM 考了两道题, 这两道题都是理论概念题, 考生应该注重此处的概念的复习。a. 制定 ERM 框架的是谁, 是董事会, 不是管理层。

b. 传统的管理方式是 fragment, 而 ERM 是 entirely

2. capm 考的是公式计算, 并且 beta 是求出来的。

An investment advisor is analyzing the range of potential expected returns of a new fund designed to replicate the directional moves of the BSE Sensex Index but with twice the volatility of the index. The Sensex has an expected annual return of 12.3% and volatility of 19.0%, and the risk free rate is 2.5% per year. Assuming the correlation between the fund's returns and that of the index is 1, what is the expected return of the fund using the capital asset pricing model?

A. 18.5%

B. 19.0%

C. 22.1%

D. 24.6%

Answer: C

If the CAPM holds, then $R_i = R_F + \beta_i \times (R_M - R_F)$, which is maximized at the greatest possible beta value which implies a correlation of 1 between the fund's return and the index return. Since the volatility of the fund is twice that of the index, a correlation of 1 implies a maximum beta β_i of 2. Therefore: $R_i (\max) = 2.5\% + 2 \times (12.3\% - 2.5\%) = 22.1\%$

3. 给出一堆数字, 然后直接用计算器求样本均值和标准差

Assume you and your research assistant are evaluating the stock of AXZ Corporation. You have calculated the stock returns for AXZ over the last 12 years to develop the following data set. Your research assistant has decided to conduct his analysis using only the returns for the five most recent years, which are displayed as the bold numbers in the data set.

Given this information, calculate the mean and the standard deviation?

Data set: 25% 34% 19% 54% 17%

答案: 直接计算器计算: 2ND-7-2ND-CLR WORK(左下角的键, 此步骤是清空内容)-25-ENTER.....(输入所有的数字在 X, Y 保持都是 1)-2ND-8, 找到均值和标准差的答案, 注意要选择样本的标准差, 计算器中显示的是 S_x

考了权证的价值, 但是提到了 BSM 定价模型。

5.考了美式看跌期权的最小价值

Option	Proxy	Min Value	Max Value
European call	C	$\max(0, S_0 - Xe^{-rT})$	S_0
American call	C	$\max(0, S_0 - Xe^{-rT})$	S_0
European put	P	$\max(0, Xe^{-rT} - S_0)$	Xe^{-rT}
American put	P	$\max(0, X - S_0)$	X

The current stock price of a share is USD 100, and the continuously compounding risk-free rate is 12% per year. The maximum possible prices for a 3-month European call option, American call option, European put option, and American put option, all with strike price of USD 90, are:

- A. 100, 100, 87.34, 90
- B. 100, 100, 90, 90
- C. 97.04, 100, 90, 90
- D. 97.04, 97.04, 87.34, 87.34

→ Correct Answer: A

6.ES 考了两道题，其中一道是如果 α 增加，统计时间增加，问 ES 怎么变化的

Expected Shortfall(Conditional VaR)，显著性水平变大，ES 会变小，统计时间增加（统计的数据增加）那 ES 的变化可能会变大可能不变可能变小，故最终的 ES 值不确定如何变化。

7.求 VaR 值，不同的显著性水平，不同的天数

巴塞尔协议要求：99%的置信水平下资产规模 P，1-day, VaR=100m，求 RM 协议要求：95%的置信水平，10-day 的 VaR。

$100m = 2.33 \sigma P$ 求出 σ ，带入 $1.65 \sigma * \sqrt{10}P$ ，得出答案。

8.泊松分布，给一天的的值，要求 2 天的

A call center receives an average of two phone calls per hour. The probability that they will receive 20 calls in an 8-hour day is closest to:

- A. 5.59%
- B. 16.56%
- C. 3.66%

D. 6.40%

Correct Answer: A

λ To solve this question, we first need to realize that the expected number of phone calls in an 8-hour day is 16. Using the Poisson distribution, we solve for the probability that X will be 20.

$$P(X=20) = \frac{16^{20} e^{-16}}{20!} = 5.59\%$$

9. 二项分布:很简单不解释

Assume a 99% daily VaR model is perfectly accurate. Specifically, among 100 days, we expect a loss that exceeds VaR on exactly one day. Using a binomial distribution, over a series of 20 trading days, which is nearest to the probability that the daily loss will exceed VaR on exactly two days?

A. 0.44%

B. 0.93%

C. 1.59%

D. 2.36%

Correct Answer: C

10. 求组合的久期和凸度

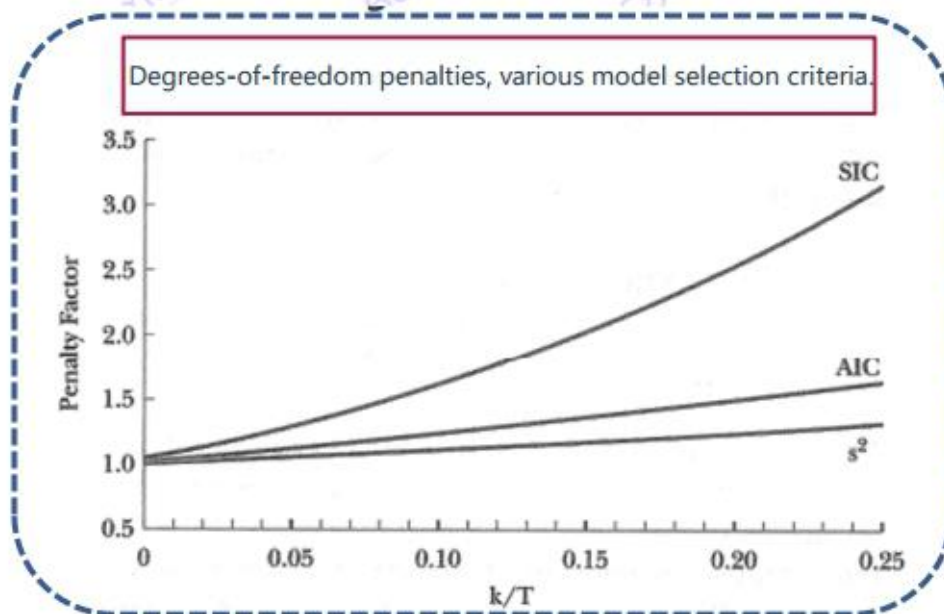
Example: Using the portfolio as outlined in the following figure, calculate the portfolio duration and convexity (semiannual coupon payment)

Coupon	Maturity	YTM	Price(% of par)	Par(millions)	Weights	D	C
5.00%	5	4.00%	104.49 12925	3	22.97%	4.41	22.92
6.00%	15	5.00%	110.46 51463	4	32.37%	10.11	132.54
7.00%	30	5.50%	121.91 69965	5	44.66%	14.00	299.36

$$D = (0.2297 \times 4.41) + (0.3237 \times 10.11) + (0.4466 \times 14) = 10.54$$

$$C = (0.2297 \times 22.92) + (0.3237 \times 132.54) + (0.4466 \times 299.36) = 181.86$$

11. SIC 的图：问哪一条线是 SIC 的图



12. 贝叶斯，全概率公式，好的经济下多少是上升的，多少是下降的。

Next year the economy will experience one of three states: downturn, stable state, or growth. The following probability matrix is as follow:

		Economy		
		Downturn	Stable	Growth
Bond	Survive	19.40%	49.00%	29.70%
	Default	0.60%	1.00%	0.30%

If we observe that the bond has defaulted, what is the probability that the economy experienced a downturn?

- A. 0.60%
- B. 19.40%
- C. 26.33%
- D. 31.58%

➤ Correct Answer : D

13. T 分布是不是肥尾，以及大部分概率在哪

T 分布是矮峰肥尾, 相对于正态分布发生的概率大部分发生在尾部, 小部分发生在均值附近

14. 给出两个正太分布, 然后将两个正太分布线性组合后, 求出组合后的正太分布的均值和方差

15. 求 Information Ratio 和 Sharp Ratio, IR 有两道题

29. Gregory is analyzing the historical performance of two commodity funds tracking the Reuters/Jefferies-CRB Index (CRB) as benchmark. He collated the data on the monthly returns and decided to use the information ratio (IR) to assess which fund achieved higher returns more efficiently and presented his findings.

	Fund I	Fund II	Benchmark returns
Average monthly returns	1.488%	1.468%	1.415%
Average excess return	0.073%	0.053%	0.000%
Standard deviation of returns	0.294%	0.237%	0.238%
Tracking error	0.344%	0.341%	0.000%

What is the information ratio for each fund and what conclusion can be drawn?

- A. IR for Fund I = 0.212, IR for Fund II = 0.155; Fund II performed better as it has a lower IR.
- B. IR for Fund I = 0.212, IR for Fund II = 0.155; Fund I performed better as it has a higher IR.
- C. IR for Fund I = 0.248, IR for Fund II = 0.224; Fund I performed better as it has a higher IR.
- D. IR for Fund I = 0.248, IR for Fund II = 0.224; Fund II performed better as it has a lower IR.

Answer: B

16. 用 EWMA 求 ρ

- Suppose that $\lambda = 0.95$ and that the estimate of the correlation between two variable X and Y on day $n - 1$ is 0.6. Suppose further that the estimate of the volatilities for the X and Y on day $n - 1$ are 1% and 2%, respectively. From the relationship between correlation and covariance, the estimate of the covariance between the X and Y on day $n - 1$ is:

$$\text{Cov}_{n-1} = 0.6 \times 0.01 \times 0.02 = 0.00012$$

- Suppose that the percentage changes in X and Y on day $n - 1$ are 0.5% and 2.5%, respectively. The variance and covariance for day n would be updated as follows:

$$\begin{aligned}\sigma_{x,n}^2 &= 0.95 \times 0.01^2 + 0.05 \times 0.005^2 \\ &= 0.00009625\end{aligned}$$

$$\begin{aligned}\sigma_{y,n}^2 &= 0.95 \times 0.02^2 + 0.05 \times 0.025^2 \\ &= 0.00041125\end{aligned}$$

$$\text{Cov}_n = 0.95 \times 0.00012 + 0.05 \times 0.005 \times 0.025 = 0.00012025$$

$$\hat{\rho}_{xy} = \frac{\text{Cov}_n}{\sigma_{x,n} \sigma_{y,n}} = \frac{0.00012025}{\sqrt{0.00009625} \times \sqrt{0.00041125}} = 0.6044$$

17. 总体方差相同的情况下, 给出 **excess kurtosis** 等于 3, **skewness** 等于 0, 均值为 0, 与正太分布进行对比.

高峰肥尾, 注意当 **kurtosis=3**, 或者 **excess kurtosis=0** 的时候才是正太分布的 峰值。

18. 求 UL

- Suppose XYZ bank has booked a loan with the following characteristics: total commitment of \$2,000,000, of which \$1,200,000 is currently outstanding. The bank has assessed an internal credit rating equivalent to a 1% default probability over the next year. Draw down upon default is assumed to be 75%. The bank has additionally estimated a 40% loss given default. The standard deviation of EDF and LGD is 5% and 30%, respectively. Calculate the unexpected loss for XYZ bank.

$$\checkmark AE = 1,200,000 + 800,000 \times 75\% = 1,800,000$$

$$\checkmark UL = AE \times \sqrt{PD \times \sigma_{LR}^2 + LR^2 \times \sigma_{PD}^2}$$

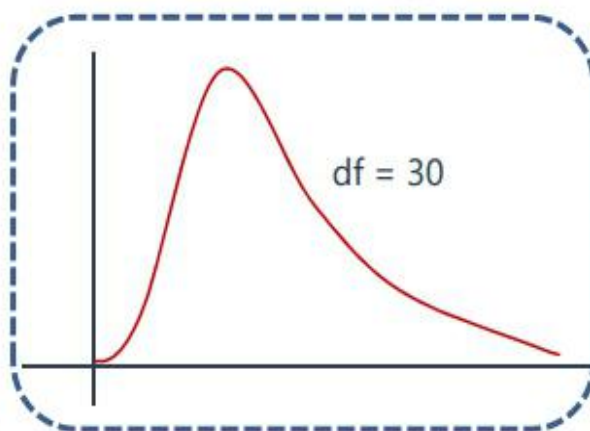
$$= AE \times \sqrt{1\% \times 30\%^2 + 40\%^2 \times 5\%^2} = 64,900$$

19. Loss frequency 和 loss severity distribution 用什么分布

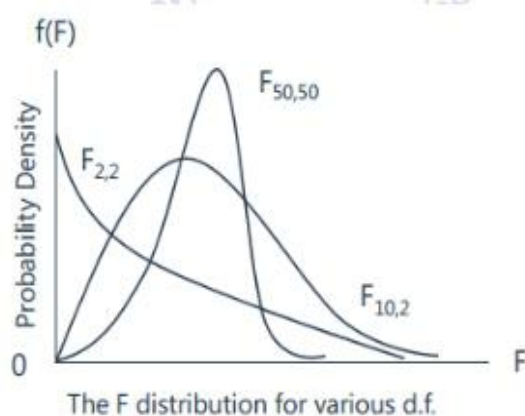
Loss frequency: 用泊松分布; loss severity: 用 lognormal 分布

20. 卡方分布和 F 分布是大于 0 的

记住两个分布的图形



卡方分布



F 分布

21. 协方差平稳时，协方差的条件

协方差平稳的条件：

- Constant and finite covariance between values at any given lag.

$$\gamma(t, \tau) = \text{cov}(y_t, y_{t-\tau}) = E(y_t - \mu)(y_{t-\tau} - \mu) = \gamma(\tau)$$

22. Adjusted R^2 的四个知识点，即增加变量 R^2 怎么变，Adjusted R^2 怎么变

Potential pitfalls when using the R^2 or adjust R^2

- ✓ An increase in the R^2 or adjust R^2 does not necessarily mean that an added variable is statistically significant.
- ✓ A high R^2 or adjust R^2 does not mean that the regressors are true cause of the dependent variable
- ✓ A R^2 or adjust R^2 does not mean that there is no omitted variable bias.
- ✓ An increase in the R^2 or adjust R^2 does not necessarily mean you have the most appropriate set of regressors, nor does a low value mean an inappropriate set of regressors

23. Serial correlation (autocorrelation), 会引起 t 统计量的变化.

系数不受影响, 标准误受影响

24. BSM 反推波动率 (implied volatility) 方法的缺点

The disadvantages of implied volatility is that implied volatility is model dependent. (1) Options on the same underlying asset may trade different implied volatilities. (2) The model assumes constant volatility, but volatility tends to change over time. (3) Limited availability because it requires traded price.

25. Garch 模型, 给出长期波动率, α , β , 波动率, 收益率, 求出下一期的波动率

Example

- Suppose that a GARCH(1, 1) model is estimated from daily data as:

$$\sigma_n^2 = 0.000002 + 0.13u_{n-1}^2 + 0.86\sigma_{n-1}^2$$
- This corresponds to $\alpha = 0.13$, $\beta = 0.86$, $\omega = 0.000002$
- Because $\gamma = 1 - \alpha - \beta$, it follows that $\gamma = 0.13$
- Because $\omega = \gamma V_L$, it follows that $V_L = 0.0002$. This corresponds to a volatility of $0.014 = 1.4\%$ per day.
- Suppose that the estimate of volatility on day $n - 1$ is 1.6% per day, and that on day $n - 1$ the market variable decreased by 1% . Then:

$$\sigma_n^2 = 0.000002 + 0.13 \times 0.01^2 + 0.86 \times 0.016^2 = 0.00023516$$
- The new estimate of the volatility is therefore $0.0153 = 1.53\%$ per day.

26. 风险文化：找不到题，去看书。

27. 下列各项哪一项是风险管理的失败

28. 求出 UL, 并题目中给出 capital multiplier, 然后要求 economical capital.

$$\text{Economic Capital}_p = UL_p \times CM$$

29. Risk committee 的任务: 看书

30. Audit committee 的任务: 看书

31. APT 模型, 用 mean-variance 条件是错的

Mean-variance 是 CAPM 模型的假设, 不是 APT 模型的

32.Repo 金融危机中的脆弱点

Triggers and vulnerabilities that led to the financial crisis.

- **Losses on subprime mortgages, after house prices started to decline, were a trigger for the crisis. However,** subprime losses were clearly not large enough on their own to account for the magnitude of the crisis .
- **Shadow banks**
 - ✓ Shadow banks are financial entities other than regulated depository institutions (commercial banks, thrifts, and credit unions) that serve as intermediaries to channel savings into investment.
- **Bank run**
 - ✓ The systemic vulnerabilities in large part

The main vulnerability was short-term debt, mostly **repurchase agreements** and **Asset-backed commercial paper**.

33.道德考的很简单

34.凸度的影响，价格上升升的多，下降降的少

35.一个选项考了长期国债：actual/actual

Accrued Interest and Day Count Conventions

- Treasury bonds: actual/ actual
- Corporate and municipal bonds: 30/360
- Money market instruments (Treasury bills): actual/360

36.求 clean price,

➤ Example

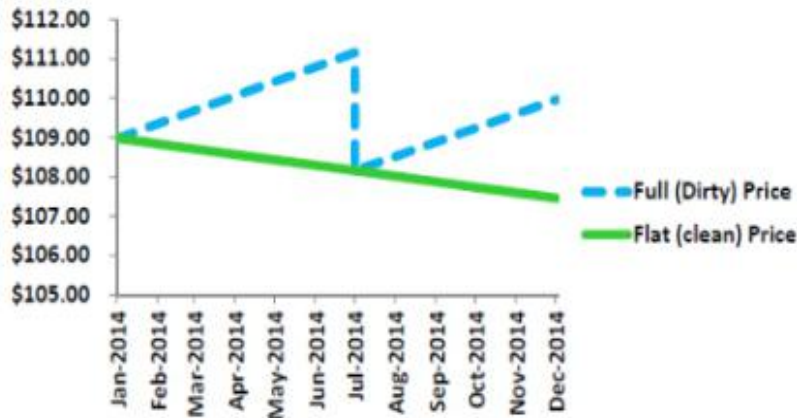
- Suppose a 1000 par value US corporate bond pays a semi-annual 10 percent coupon on January 1 and July 1. Assume that it is now April 1, 2005, and the bond matures on July 1, 2015.
 - ✓ Compute the invoice (full) price of this bond if the required annual yield is 8 percent.
 - ✓ Compute the flat (clean) price of the above bond.

Time	Feb 1st	Mar 1st	Apr 1st	May 1st	June 1st	July 1st
dirty price	1147.77	1155.30	1162.87	1170.50	1178.18	1185.90
clean price	1139.44	1138.63	1137.87	1137.17	1136.51	1135.90

Answer

- $N = 20$, $I/Y = 4$, $PMT = 50$, $FV = 1000$
- CPT: Price (Jul 1) = 1135.90
- Price (Apr 1) = $(1135.90 + 50) / 1.04^{0.5} = 1162.87$ (dirty price)
- $AI = 50 \times 90 / 180 = \25 (3 months)
- clean price = $1162.87 - 25 = \$1137.87$

37.要知道 full price 大于等于 clean price: 最好记住两者的关系图



38.远期公式，用的是各种的率：

A risk analyst observes that an emerging market stock index has hit a new all-time high with a value of 10,000, measured in the emerging market's currency. The analyst suggests buying futures on the index as a hedge on the firm's short exposure to this market. If the interest rate is 4% annually in this market and the average annualized dividend yield on the index for the next six months is 1%, what is the approximate price of a 6-month futures contract on the index in the emerging market's currency?

- A. 9,700
- B. 9,850
- C. 10,150
- D. 10,300

Correct Answer: C

39.保证金，计算变动保证金。

- To utilize the cash position of assets under management, a portfolio manager enters into a long futures position on the S&P 500 index with a multiplier of 250. The cash position is \$15 million which at the current futures value of 1,000, requires the manager to be long 60 contracts. If the current initial margin is \$12,500 per contract, and the current maintenance margin is \$10,000 per contract, what variation margin does the portfolio manager have to advance if the futures contract value falls to 995 at the end of the first day of the position being placed?
- A. \$30,000
B. \$0
C. \$300,000
D. \$75,000
- Correct Answer: B

$$5 \times 250 = 1250$$

$$12500 - 1250 = 11250 > 10000, \text{ 所以不用增加保证金}$$

40. Short hedge = long basis, 一个选项中考了。

41. 给出现在的汇率, 求出未来的汇率, 考察利率平价公式。

Example: Interest Rate Parity

The 2-year interest rates in Australia and the US are 5% and 7% respectively (continuously compounding). The spot rate is 0.6200 USD per AUD. Calculate 2-year forward rate. If it is 0.6300, how to arbitrage?

$$0.6200e^{(0.07-0.05) \times 2} = 0.6453 > 0.6300$$

0.62USD/AUD

$$\text{Forward} = \text{Spot} \times e^{(r_a - r_b)T}$$

42. 所有的对冲的公式都要记住, 考试中对冲至少考了5道题

43. 6个素中, 哪些能提高期权的价格

Factor	European call	European put	American call	American put
S	+	—	+	—
K	—	+	—	+
T	?	?	+	+
σ	+	+	+	+
r	+	—	+	—
D	—	+	—	+

44. 二值期权, cash or nothing 的价格

Cash or nothing call: $Qe^{-rT}N(d_2)$

Asset or nothing call: $S_0e^{-qT}N(d_1)$

45. MBS 提前还款, 没有让求 CPR 和 SMM 而是让求提前还了多少.

$SMM = \text{prepayment} / (\text{principle} - \text{计划本金偿付})$

$1 - CPR = (1 - SMM)^{12}$

82. If a pool of mortgage loans begins the month with a balance of \$10,500,000, has a scheduled principal payment of \$54,800, and ends the month with a balance of \$9,800,000, what is the CPR for this month?
- A. 6.18%
 - B. 42.24%
 - C. 53.47%
 - D. 66.67%

$SMM = (10,500,000 - 9,800,000 - 54,800) / (10,500,000 - 54,800) = 0.06177$

$1 - CPR = (1 - SMM)^{12}$, 算出 $CPR = 53.47\%$

46.考了 OAS.

47.银行存款保险制度 **deposit insurance**, 道德风险

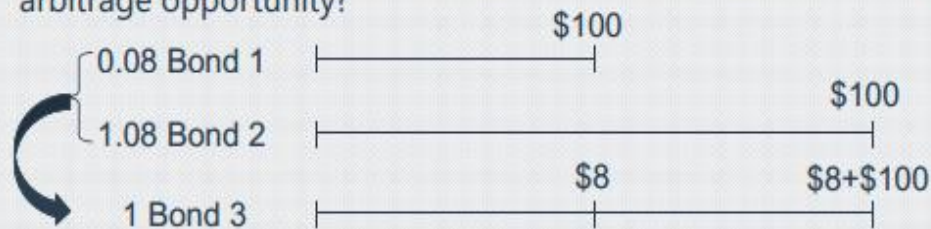
48.DB plan 和 DC plan 的区别：没讲过

49.债券复制：

➤ Example: Three bond yields and prices are shown below.

	Maturity	YTM	Coupon	Price (% of par)
1	1 year	4%	0%	96.154
2	2 years	8%	0%	85.734
3	2 years	8%	8%	100

- The 2-year spot rate is 8.167%. Is there an arbitrage opportunity using these three bonds? If so, describe the trades necessary to exploit the arbitrage opportunity?



➤ Answer:

- $0.08 B_1 + 1.08 B_2 = B_3$
- $0.08 \times 96.154 + 1.08 \times 85.734 = 100.285$ (not 100)
- Bond 3 is undervalued, so we buy Bond 3. Bond 1 and Bond 2 are overvalued, and we sell them together.

50.求 ES, 历史模拟法, 然后过了 10 天后, 数据更新.

47. A risk manager is estimating the 1-day 95% VaR on a domestic equity portfolio using a 100-day lookback period. The mean return, estimated from the historical data, is 0% with a standard deviation of 2%. The six most extreme negative returns over the lookback period, along with the time they occurred, are:

Order	Return	Number of Days Ago
1	-10%	95
2	-6.3%	17
3	-4.7%	65
4	-4%	4
5	-3.8%	5
6	-3.6%	30

Over a period of 10 days after the risk manager computed the portfolio's VaR, four new extreme declines occurred: -25%, -4.1%, -7.8% and -9.5%. On the other six days, the portfolio experienced positive returns. The risk manager must now update the previous VaR estimate to account for these changes. Assuming the portfolio has a current value of USD 100 million, what is the updated 1-day 95% VaR using the historical approach?

- A. USD 3.28 million
- B. USD 4.70 million
- C. USD 10 million
- D. USD 25 million

Answer: B

-25%, -9.5%, -7.8%, -6.3%, -4.7%

51. 协方差平稳中, 均值是 **time varying (X)**

52. 评级两年后违约的概率

59. Given the following 1-year transition matrix, which of the following amounts is closest to the probability that an Aaa-rated firm will default over a 2-year period?

Rating from	Rating to			
	Aaa	Baa	Caa	Default
Aaa	90%	10%	0%	0%
Baa	10%	80%	5%	5%
Caa	1%	4%	80%	15%

- A. 0.00%.
- B. 0.23%.
- C. 0.50%.
- D. 0.65%.

Answer: C

Aaa-Aaa-D: 0

Aaa-Baa-D: $10\% \times 5\% = 0.5\%$

Aaa-Caa-D: 0%

Aaa-D: 0%

53. Through cycle 和 at the point 的区别和特点。

➤ Which of the following is not a true statement about internal credit ratings?

- A. The "at-the-point-in-time" approach makes heavy use of econometric modeling that relates current financial variables to estimated default risk.
- B. The "through-the-cycle" approach is forward-looking and attempts to incorporate future economic scenarios into current default risk estimates.
- C. "At-the-point-in-time" credit scores volatility is much higher than "through-the-cycle" score volatility.
- D. A sound internal system uses at-the-point-in-time scoring for small-to-medium-sized companies and private firms and through-the-cycle scoring for large firms.

➤ Correct Answer : D

54. 国家风险考了两道题：看书

55. 操作风险一个选项考了 basic indicator

$$K_{\text{operational,BIA}} = \frac{\sum_{i=\text{last three years}} (GI_i \times \alpha)}{3}$$

56. 压力测试考了两道题: 看书

57. 题中给出的是 FRA, 但是题中给出的条件都是利率互换的条件。实际上就是要求利率互换的。

Example: Consider a \$1 million notional swap that pays a floating rate based on 6-month LIBOR and receives a 6% fixed rate semiannually. The swap has a remaining life of 15 months with pay dates at 3, 9 and 15 months. Spot LIBOR rates are as following: 3 months at 5.4%; 9 months at 5.6%; and 15 months at 5.8%. The LIBOR at the last payment date was 5.0%. Calculate the value of the swap to the fixed-rate receiver using the bond methodology.

$$\text{Bond}_{\text{Fixed}} = 30,000 \times e^{-5.4\% \times 0.25} + 30,000 \times e^{-5.6\% \times 0.75} + 1,030,000 \times e^{-5.8\% \times 1.25} = 1,016,332$$

$$\text{Bond}_{\text{Float}} = (1,000,000 + 25,000) \times e^{-5.4\% \times 0.25} = 1,011,255$$

$$V_{\text{swap}} = \text{Bond}_{\text{Fixed}} - \text{Bond}_{\text{Float}} = 1,016,332 - 1,011,255 = 5,077$$

58. Callable bond 和 MBS, 是谁买了 call 的问题。

Callable bond: 发行人买了个 call

MBS: 借款人买了个 call

59. 股权对冲, 给出 β , 想把 1.4 的 β 对冲到 1.7, 问买或者卖, 多少。

The current value of the S&P 500 index is 1,457, and each S&P futures contract is for delivery of 250 times the index. A long-only equity portfolio with market value of USD 300,000,000 has beta of 1.1. To reduce the portfolio beta to 0.75, how many S&P futures contract should you sell?

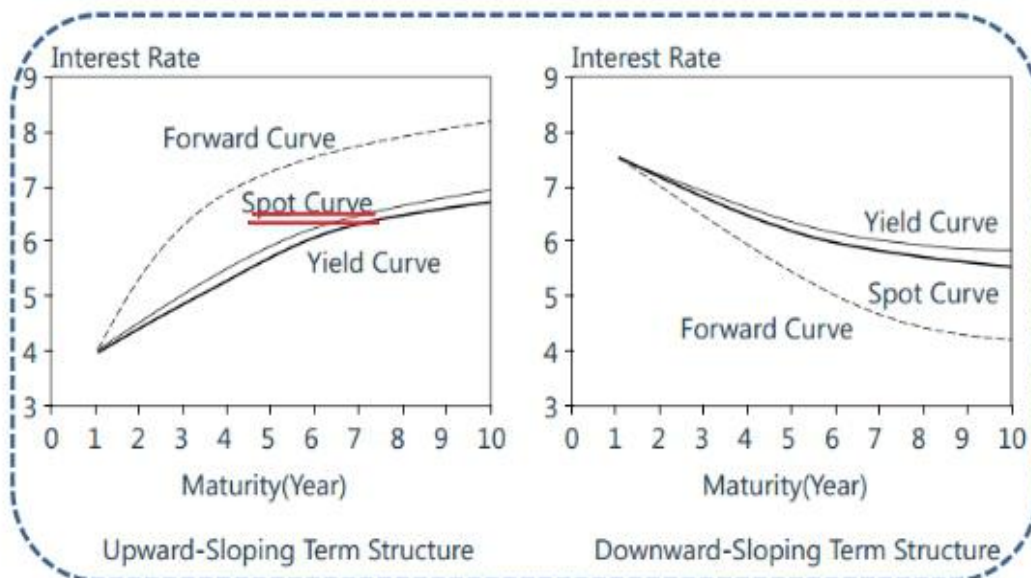
- A. 288 contracts
- B. 618 contracts
- C. 906 contracts
- D. 574 contracts

Correct Answer: A

$$\text{number of contracts} = (\beta^* - \beta) \times \frac{\text{portfolio value}}{\text{value of futures contract}}$$

$$(0.75 - 1.1) \times 300,000,000 / (250 \times 1457) = -288$$

60. 市场利率上升的时候，三条曲线的位置



Coupon-bearing curve: yield curve, par rate

Zero-coupon curve: spot curve

61. 私募基金和共同基金之间的区别

➤ Hedge Funds vs. Mutual Funds

- **Mutual funds**, which are called "unit trusts" in some countries, serve the needs of relatively small investors, while hedge funds seek to attract funds from wealthy individuals and large investors such as pension funds.
- **Hedge funds** are subject to much less regulation than mutual funds because they accept funds only from financially sophisticated individuals and organizations. This gives them a great deal of freedom to develop sophisticated, unconventional, and proprietary investment strategies. Hedge funds are sometimes referred to as alternative investments.
- **Hedge funds** are free to use a wider range of trading strategies than mutual funds and are usually more secretive about what they do. Mutual funds are required to explain their investment policies in a prospectus that is available to potential investors.

62. 保险求那个 PV

Insurance Companies

➤ Life Insurance-Valuation of Life Insurance Contracts

- Mortality tables are the key to valuing life insurance contracts.

Age (Years)	Male			Female		
	Probability of Death within 1 Year	Survival Probability	Life Expectancy	Probability of Death within 1 Year	Survival Probability	Life Expectancy
0	0.006990	1.00000	75.90	0.005728	1.00000	80.81
1	0.000447	0.99301	75.43	0.000373	0.99427	80.28
2	0.000301	0.99257	74.46	0.000241	0.99390	79.31
3	0.000233	0.99227	73.48	0.000186	0.99366	78.32
...
90	0.168352	0.16969	4.02	0.131146	0.28649	4.85
91	0.185486	0.14112	3.73	0.145585	0.24892	4.50
92	0.203817	0.11495	3.46	0.161175	0.21268	4.19
93	0.223298	0.09152	3.22	0.177910	0.17840	3.89

Example: Assume the interest rates for all maturities are 4% per annum (with semiannual compounding). Premiums are paid once a year at the beginning of the year. Given the above mortality tables, what is an insurance company's break-even premium for \$100,000 of life insurance for a man of average health aged 90?

Scenario 1: The term insurance lasts one year and the payout occurs halfway through the year.

Expected payout: $0.168352 \times 100,000 = \$16,835$

Premium: $16,835/1.02 = \$16,505$

Scenario 2: The term insurance lasts two years. The payout in the first year occurs halfway through the year. The payout in the second year occurs at time 18 months.

(continued)

Present value of expected payout in the first year: \$16,505

Probability that the policyholder dies during the second year is:

$$(1 - 0.168352) \times 0.185486 = 0.154259$$

Present value of expected payout in the second year:

$$0.154259 \times 100,000/(1.02^3) = \$14,536$$

Total present value of payouts is: $\$16,505 + \$14,536 = \$31,041$

Suppose the premium is X dollars per year, the present value of the premium payments is:

$$X + (1 - 0.168352)X/(1.02^2) = 1.799354X$$

The break-even annual premium is the value of X that solves:

$$1.799354X = 31,041 \rightarrow X = \$17,251$$

63.相同期限的零息债券和付息债券之间的收益率谁高

64.关于 ARMA 模型的 cut off。

	ACF	PCF
MA(1) model	cut off	Decay
AR(1) model	Decay	Cut off



Yule-Walker Equation: $\gamma(\tau) = \phi \gamma(\tau - 1)$

65. 分析师不确定未来市场是涨还是跌，但是其认为很大几率会涨，问期权策略，有 box spread, 牛市看涨，covered call, butterfly 等选项

66. 给 ESS, SSR 求相关系数

$R^2 = ESS/TSS$, 然后开方求出相关系数

67. 历史模拟法和隐含波动率法 implied volatility-based approach 的优点和缺点

The **implied volatility-based approach** uses derivative pricing models such as the Black-Scholes-Merton option pricing model to estimate an implied volatility based on current market data rather than historical data.

- ✓ The advantage of implied volatility is the forward-looking predictive nature of the model. The implied volatility model reacts immediately to changing market conditions.
- ✓ The disadvantages of implied volatility is that implied volatility is model dependent. (1) Options on the same underlying asset may trade different implied volatilities. (2) The model assumes constant volatility, but volatility tends to change over time. (3) Limited availability because it requires traded price.

Historical Simulation

- No parameter estimates are required, the only thing we need to determine up front is the lookback window. Once the window length is determined, we order returns in descending order, and go directly to the tail of this ordered vector.
- The model is not subject to estimation error related to correlations and the problem of higher correlations in downward markets.

68. 二叉树考了两题，one-step 的一个是求期权价值

69. 另一个是给出风险中性上升概率，求波动率

$$u = e^{\sigma\sqrt{\Delta t}}; d = e^{-\sigma\sqrt{\Delta t}}$$

70.蒙特卡洛模拟，反向对称法 **Antithetic variates**，四个选项都是公式，找出-x 就可以

这道题告知了要用反向对称法，然后 A: $X+3$; B: $3X+4$;

C: $(4-X)/2$; D: X^2+5 ; 选 C

71.蒙特卡罗模拟，关于增加模拟次数.

The 95% confidence interval for the output of ending capital is calculated to be (\$117.03, \$122.97) for a simulation run with 100 scenarios. In addition, the simulation resulted in a mean ending capital amount of \$120 with a standard deviation of \$15. Suppose we want to improve the accuracy of this confidence interval by running a simulation of 400 scenarios. What is the new 95% confidence interval with a simulation of 400 scenarios using the same mean and standard deviations from the model with 100 scenarios?

- A. (\$117.23, \$122.95)
- B. (\$118.52, \$121.48)
- C. (\$119.02, \$121.99)
- D. (\$119.71, \$122.27)

Correct Answer : B

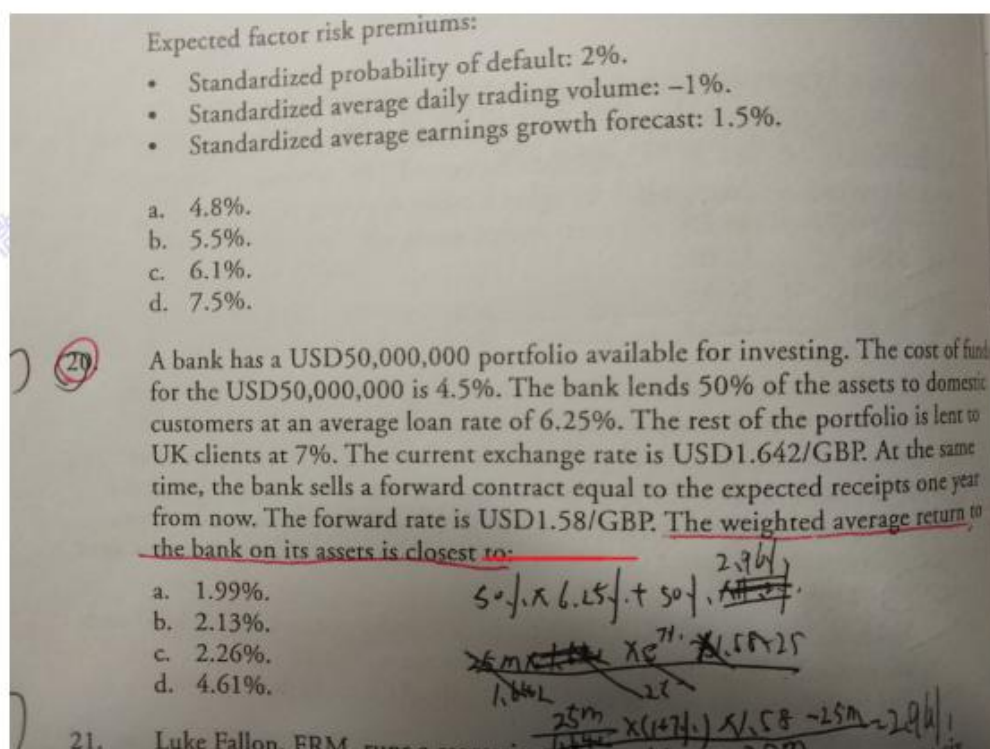
$$S_x = \sqrt{\frac{\text{var}(x)}{N}}$$

$$\begin{aligned}120 \pm 1.96\sigma &= 122.97 \\ \sigma &= 1.52 \\ S &= \sqrt{\frac{1.52^2}{400}} = 0.076 \\ \underline{1.96 \times 0.076} \pm 120 &= (118.52, 121.48)\end{aligned}$$

72. 双尾 T 检验，查表时给出的是单尾，

73. 保险公司 long 一个长期 bond 是对冲什么风险，有寿险，长期年金

74. 有一个组合 100 万，然后 50 万投资在本国市场，50 万投资在外国市场，最终求这个收益率



$$\frac{25,000,000}{1.642} * (1 + 7\%) * 1.58 - 25,000,000 = 2.96\%$$

$$(6.25\% + 2.96\%) / 2 = 4.61\%$$

75. 三个股票，分别由 β_1 , β_2 决定。

	β_1	β_2
股票 1	1.2	-0.3
股票 2		
股票 3		

然后用股票 1 和 2 的对冲使股票 3 的 β_1 和 β_2 为特定的数

76. 正常的货币互换的题

Example: At the outset of the swap, company A pays a principal amount to B of USD 175 million, and B pays GBP 100 million to A. Both parties pay the interest rate of the borrowed currency (USD 5%, GBP 6%). At the end of the swap, the principal amounts are re-exchanged. Suppose the yield curves in the United States and Great Britain are flat at 2% and 4%, respectively, and the current spot exchange rate is USD1.50 = GBP1. Value the currency swap just discussed assuming the swap will last for three more years.

$$\text{Bond}_{\text{USD}} = 8.75 \times e^{-2\% \times 1} + 8.75 \times e^{-2\% \times 2} + 183.75 \times e^{-2\% \times 3} = 190.0329 \text{ million}$$

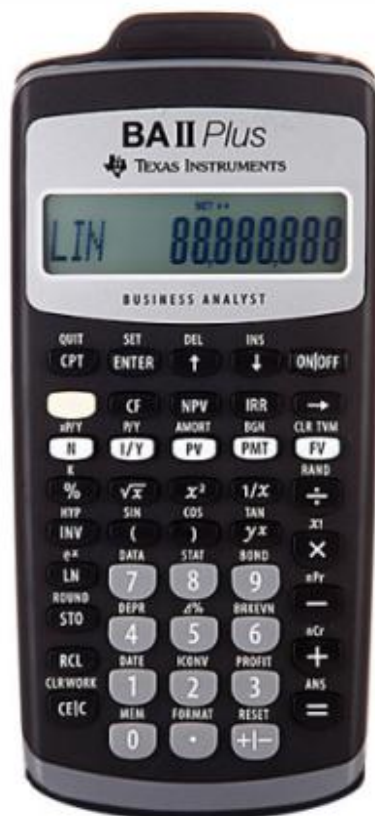
$$\text{Bond}_{\text{GBP}} = 6 \times e^{-4\% \times 1} + 6 \times e^{-4\% \times 2} + 106 \times e^{-4\% \times 3} = 105.3170 \text{ million}$$

$$V_{\text{swap}(\text{received USD})} = 190.0329 - 1.5 \times 105.3170 = 32.06 \text{ million}$$

考试须知

1. 携带的物品：只让带证件（护照和驾照），准考证（不允许任何的涂写），官方授权的计算器，铅笔（考试时提供两只铅笔）。其他的类似于卷笔刀，纸巾，橡皮，电子设备，笔，手机，什么的其他的一律不许带，然后手机关机，有响声的话考试取消成绩（注意手机关机的时候一定不要设置闹铃，因为挂机后到时间闹铃一样会响）。计算器电池不让带。

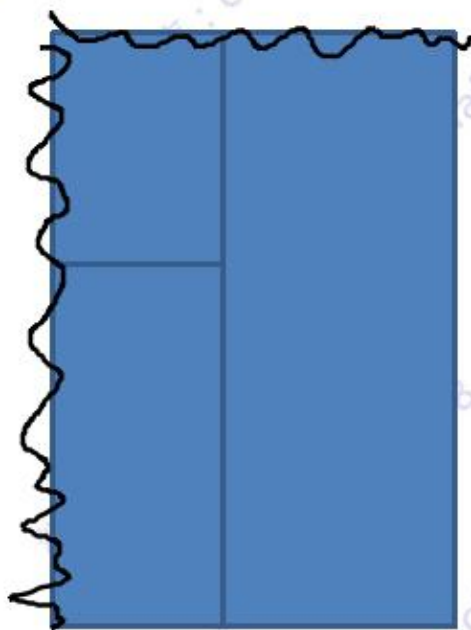
商品展示 PRODUCT PARAMETERS



2. 考试时间：FRM，1级四个小时，8:00 开始考，7:45 之前必须进场。（我考场有一个 7:55 进场的，也让其进了），最后半个小时的时候就不让提前交卷了和上厕所了。

- 3.考场中是禁止吃东西和喝水的，如果希望去洗手间，像考官示意，一次只能去一个人。
- 4.千万不要提前答题，不要时间到还答题或涂卡。很有可能会被算违规。
- 5.开考前会英文报读考试注意事项，然后监考老师还会用中文读一遍，监考老师如果没有让拆开考卷前，不要拆开，否则算违规。
- 6.考场三个监考，不要有任何的作弊情况，如果真的出现违规情况，要好好的与考官解释并且承认错误，尽力取得他们的原谅。
- 7.涂卡:FRM 考试中是答题卡是有一个复写纸的。

由于不许使用橡皮，所以其修改有一些特殊的要求



AO BO CO DO _____

3A○ B○ C● D○ _____

A○ B● C● D○ B