

MOCK EXAM 1 - ANSWERS

Question 1

An investor believes there are three important factors that determine the expected return for a common stock. The investor uses the following factor betas and factor exposures.

Factors	Factor Betas	Factor Exposures
1	0.7	1.5%
2	1.2	4.0%
3	-0.1	5.0%

If the risk-free rate is 3%, what is the expected return for this stock using the arbitrage pricing theory (APT) model?

- A) 5.35%.
- B) 8.35%. ✓**
- C) 9.50%.
- D) 10.37%.

Explanation

$$E(R) = 0.03 + 0.7(0.015) + 1.2(0.04) - 0.1(0.05)$$

$$E(R) = 0.03 + 0.0105 + 0.048 - 0.005$$

$$E(R) = 0.0835$$

(Book 1, Module 6.2, LO 6.e)

Question 2

A \$1,000 par corporate bond carries a coupon rate of 6%, pays coupons semiannually, and has 10 coupon payments remaining to maturity. Market rates are currently 5%. There are 90 days between settlement and the next coupon payment. The dirty and clean prices of the bond, respectively, are closest to:

- A) \$1,043.76, \$1,013.76.
- B) \$1,043.76, \$1,028.76.
- C) **\$1,056.73, \$1,041.73.** ✓
- D) \$1,069.70, \$1,054.70.

Explanation

The dirty price of the bond is calculated as $N = 10$; $I/Y = 2.5$; $PMT = 30$; $FV = 1,000$; $CPT \rightarrow PV = 1,043.76$. Adjusting the PV for the fact that there are only 90 days until the receipt of the first coupon gives $\$1,043.76 \times (1.025)^{90/180} = \$1,056.73$. Clean price = dirty price - accrued interest = $\$1,056.73 - \$30(90 / 180) = \$1,041.73$.

(Book 3, Module 45.1, LO 45.c)

Question 3

Which of the following statements regarding option "Greeks" is incorrect?

- A) Vega is highest when options are at-the-money.
- B) Forward instruments cannot be used to create gamma-neutral positions.
- C) **Rho is higher for at-the-money versus in-the-money options.** ✓
- D) Gamma represents the expected change in delta for a change in the value of the underlying instrument.

Explanation

In-the-money options are more sensitive to changes in rates (rho is higher) than out-of-the-money options.

(Book 4, Module 62.3, LO 62.e)

Question 4

Firm X is looking to mitigate counterparty risk by centrally clearing trades through a central counterparty (CCP). The firm is aware of some of the potential benefits of central clearing, but is concerned that the drawbacks have not been properly considered by its risk management department. Which of the following definitions is associated with the moral hazard problem of using a central counterparty?

- A) **CCPs are expected to be designated as systemically important entities. ✓**
- B) Counterparties are likely to over-trade products for which the CCP underestimates risk.
- C) Losses arising from a counterparty's default are spread across all central clearing members.
- D) When margin calls are made, members have to liquidate sufficient assets to meet the margin calls.

Explanation

Given the role CCPs play in mandatory central clearing, CCPs are expected to be designated as "systemically important" entities. As a result, the likelihood of government support or bailout in a severe stress scenario is likely. This creates a *moral hazard problem* because CCPs designated as systemically important could potentially accept higher risk and may have less stringent risk management governance knowing that a government bailout in a default scenario is likely.

(Book 3, Module 32.1, LO 32.c)

Question 5

An asset manager sells a March 2025 call on XYZ stock with an exercise price of \$45 for a \$3 premium. He also buys a March 2025 call on the same stock with an exercise price of \$40 for a \$5 premium. Identify this option strategy and the maximum profit and loss for the manager.

- A) Bear call spread, maximum profit is \$3, maximum loss is \$2.
- B) Bull call spread, maximum profit is \$3, maximum loss is unlimited.
- C) Bear call spread, maximum profit is unlimited, maximum loss is \$2.
- D) **Bull call spread, maximum profit is \$3, maximum loss is \$2. ✓**

Explanation

Bull call spread, maximum profit is \$3, maximum loss is \$2.

In a bull call spread, the buyer of the spread purchases a call option with a low exercise price, X_L , and subsidizes the purchase price of the call by selling a call with a high exercise price, X_H .

The maximum profit will occur at any stock price over the high exercise price. For example, at a stock price of \$50: Maximum profit: $10 - 5 - 5 + 3 = \$3$.

The maximum loss will occur at any stock price below the low exercise price. For example, at a stock price of \$35: Maximum loss: $0 - 0 - 5 + 3 = -\$2$.

(Book 3, Module 40.2, LO 40.c)

Question 6

Based on a sample size of 100 and a sample mean of \$30, a risk analyst estimates a 95% confidence interval for the mean weekly soft drink expenditures of students at a local college. His estimate of the confidence interval is \$26.77 to \$33.23. Since the analyst knew the standard deviation beforehand, the confidence interval was based on a standard deviation closest to:

- A) 1.65.
- B) 6.59.
- C) 11.53.
- D) **16.48. ✓**

Explanation

With a known variance, the 95% confidence interval is constructed as $\bar{x} \pm 1.96 \frac{\sigma}{\sqrt{n}}$. So the analyst knew $33.23 = 30 + 1.96 \frac{\sigma}{\sqrt{100}}$. Solving for σ provides 16.48.

(Book 2, Module 17.1, LO 17.d)

Question 7

Consider a 1-year European call option with a strike price of \$27.50 that is currently valued at \$4.10 on a \$25 stock. The 1-year risk-free rate is 6% compounded annually. Which of the following is closest to the value of the corresponding put option?

- A) \$0.00.
- B) \$4.95.
- C) \$5.00.
- D) **\$5.04. ✓**

Explanation

Using put-call parity: $p = c + X / (1 + r)^T - S_0 = 4.10 + (27.50 / 1.06) - 25 = \5.04 .

(Book 3, Module 39.2, LO 39.c)

Question 8

Which of the following statements comparing VaR with expected shortfall is true?

- A) Expected shortfall is sub-additive while VaR is not. ✓**
- B)** Both VaR and expected shortfall measure the amount of capital an investor can expect to lose over a given time period and are, therefore, interchangeable as risk measures.
- C)** Both VaR and expected shortfall depend on the assumption of a normal distribution of returns.
- D)** VaR can vary according to the confidence level selected, but expected shortfall will not.

Explanation

VaR measures the expected amount of capital one can expect to lose within a given confidence level over a given period of time. One of the problems with VaR is that it does not provide information about the expected size of the loss beyond the VaR. VaR is often complemented by the expected shortfall, which measures the expected loss conditional on the loss exceeding the VaR. Note that since expected shortfall is based on VaR, changing the confidence level may change both measures. A key difference between the two measures is that VaR is not sub-additive, meaning that the risk of two funds separately may be lower than the risk of a portfolio where the two funds are combined. Violation of the subadditivity assumption is a problem with VaR that does not exist with expected shortfall.

(Book 4, Module 47.2, LO 47.f)

Question 9

Cooper Industries (Cooper) is the pay-fixed counterparty in an interest rate swap. The swap is based on a notional value of \$2,000,000, and Cooper receives a floating rate based on the 6-month SOFR. Cooper pays a fixed rate of 7% semiannually. A swap payment has just been made. The swap has a remaining life of 18 months, with pay dates at 6, 12, and 18 months. Spot SOFR rates are shown in the table below.

6-month SOFR	6.5%
12-month SOFR	6.8%
18-month SOFR	7.5%
24-month SOFR	7.7%

The value of the swap to Cooper is closest to:

- A) \$0.
- B) \$10,000.
- C) **\$13,000.** ✓
- D) \$16,000.

Explanation

The fixed payments made by Cooper are $(0.07 / 2) \times \$2,000,000 = \$70,000$. The present value of the fixed payments

$$= [\$70,000 / (1 + 0.065 / 2)^1] + [\$70,000 / (1 + 0.068 / 2)^2] + [\$2,070,000 / (1 + 0.075 / 2)^3]$$

$$= \$67,797 + \$65,472 + \$1,853,557 = \$1,986,826$$

The value of the floating rate payments received by Cooper at the payment date is the value of the notional principal, or \$2,000,000. Recall that a swap payment has just been made.

The value of the swap to Cooper is $(\$2,000,000 - \$1,986,826) = \$13,174$.

(Book 3, Module 46.2, LO 46.g)

Question 10

Metallgesellschaft Refining and Marketing (MGRM) offered customers contracts to buy fixed amounts of heating oil and gasoline at a fixed price over a 5- or 10-year period. The customer contracts effectively gave MGRM a short position. MGRM hedged exposure using a rolling hedge strategy. This strategy is best described as:

- A) buying futures contracts of different expirations and allowing them to expire in sequence.
- B) buying futures contracts of different expirations and closing out the position shortly before expiration.
- C) **using short-term futures to hedge a long-term risk exposure by replacing them with newer contracts shortly before they expire. ✓**
- D) using short-term futures contracts with a larger notional value than the long-term risk they are meant to hedge.

Explanation

This strategy is called a stack-and-roll hedge and is designed to hedge long-term risk exposures with short-term contracts. Using short-term futures contracts with a larger notional value than the long-term risk they are meant to hedge could result in "over-hedging" depending on the hedge ratio.

(Book 1, Module 9.1, LO 9.a)

Question 11

Assume an investor holds a portfolio of bonds as follows:

- \$2,000,000 par value of 10-year bonds with a duration of 6.95 priced at 95.5000.
- \$3,000,000 par value of 15-year bonds with a duration of 9.77 priced at 88.6275.
- \$5,000,000 par value of 30-year bonds with a duration of 14.81 priced at 114.8750.

The duration of this portfolio is closest to:

- A) 10.64.
- B) 12.06. ✓**
- C) 13.28.
- D) 13.57.

Explanation

The duration of a portfolio of bonds is the weighted average (using market value weights) of the durations of the bonds in the portfolio. First, let's find the weights.

Bond	Price as Percentage of Par	Face Value \$	Market Value \$
1	95.5000	2,000,000	1,910,000
2	88.6275	3,000,000	2,658,825
3	114.8750	5,000,000	5,743,750
Total			10,312,575

The weights based on market values are:

$$\text{Weight of bond 1} = 1,910,000 / 10,312,575 = 0.1852$$

$$\text{Weight of bond 2} = 2,658,825 / 10,312,575 = 0.2578$$

$$\text{Weight of bond 3} = 5,743,750 / 10,312,575 = 0.5570$$

Bond	Weights	Duration	Weighted Duration
1	0.1852	6.95	1.2871
2	0.2578	9.77	2.5187
3	0.5570	14.81	8.2492
Total			12.0550

(Book 4, Module 58.2, LO 58.g)

Question 12

Vega is the sensitivity of an option's price to changes in volatility. Increases in an underlying instrument's volatility will usually increase the value of options since increases in volatility produce a greater probability that an option will find its way into the money. Of the four options listed below, which investment has the potential to produce a negative vega measure?

- A) Exchange options.
- B) Call options.
- C) Put options.
- D) **Barrier options.** ✓

Explanation

Increased volatility on down-and-out and up-and-out barrier options does not increase value because the closer the underlying instrument gets to the barrier price, the greater the chance the option will expire. Therefore, vega may be negative for a barrier option.

(Book 3, Module 41.2, LO 41.e)