**Use the following information to answer Questions 55 through 60.**

William Bow, CFA is a risk manager for GlobeCorp, an international conglomerate with operations in the technology, consumer products, and medical devices industries. Exactly one year ago, GlobeCorp, under Bow's advice, entered into a 3-year payer interest rate swap with semiannual floating rate payments based on the London interbank offered rate (LIBOR) and semiannual fixed rate payments based on a rate of 2.75%. At the time of initiation, the swap had a value of zero and the notional principal was set equal to $150 million. The counterparty to GlobeCorp's swap is NVS Bank, a commercial bank that also serves as a swap dealer. Figure 1 below summarizes the current LIBOR term structure.

**Figure 1: Current LIBOR Term Structure**

| | *Days* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 90 | 180 | 270 | 360 | 450 | 540 | 630 | 720 |
| LIBOR | 2.25% | 2.45% | 3.20% | 3.75% | 4.20% | 3.80% | 3.10% | 2.40% |

Upper management at GlobeCorp feels that the original swap has served its intended purpose but that circumstances have changed and it is now time to offset the firm's exposure to the swap. Because they cannot find a counterparty to an offsetting swap transaction, management has asked Bow to come up with alternative measures to offset the swap exposure. Bow created a report for the management team which outlines several strategies to neutralize the swap exposure. Two of his strategies are included in Figure 2.

**Figure 2: Swap Neutralization Strategies**

| *Strategy 1* | *Strategy 2* |
|---|---|
| Establish short positions in a series of off-market LIBOR forward rate agreements including a 6 × 12 FRA, 12 × 18 FRA, 18 × 24 FRA, and 24 × 30 FRA with a notional principal of $150 million for each contract. | Sell a floating rate note with a semiannual coupon payment based on 180 day LIBOR, a maturity of two years, and a par value of $150 million. |

After examining its long-term liabilities, NVS Bank has decided that it currently needs to borrow $100 million over the next two years to finance its operations. For this type of funding need, NVS generally issues quarterly coupon short-term floating rate notes based on 90-day LIBOR. NVS is concerned, however, that interest rates may shift upward and the LIBOR curve may become upward sloping. To manage this risk, NVS is considering utilizing interest rate derivatives. Managers at the bank have collected quotes on over-the-counter interest rate caps and floors from a well known securities dealer. The quotes, which are based on a notional principal of $100 million, are provided in Figure 3.

**Figure 3: Interest Rate Caps and Floors**

| | | | *Interest Rate Cap* | | *Interest Rate Floor* | |
|---|---|---|---|---|---|---|
| Term (Years) | LIBOR | Settlement | Rate | Price | Rate | Price |
| 1 | 90-day | Quarterly | 3.50% | $2,000,000 | 2.55% | $1,900,000 |
| 1 | 180-day | Semiannual | 3.50% | $2,000,000 | 2.55% | $1,900,000 |
| 2 | 90-day | Quarterly | 3.65% | $2,200,000 | 2.70% | $2,090,000 |
| 2 | 180-day | Semiannual | 3.65% | $2,200,000 | 2.70% | $2,090,000 |

One of the managers at NVS Bank, Lota Green, has expressed her distrust of the securities dealer quoting prices on the caps and floors. In a memo to the CFO, Green suggested that NVS use an alternative but equivalent approach to manage the interest rate risk associated with its two-year funding plan. Following is an excerpt from Green's memo:

"Rather than using a cap or floor, NVS Bank can effectively manage its exposure to interest rates resulting from the 2-year funding requirement by taking long positions in a series of put options on fixed-income instruments with expiration dates that coincide with the payment dates on the floating rate note."

"As a cheaper alternative, NVS can effectively manage its exposure to interest rates resulting from the 2-year funding requirement by creating a collar using long positions in a series of call options on interest rates and long positions in a series of call options on fixed income instruments all of which would have expiration dates that coincide with the payment dates on the floating rate note."

55. Determine how the value of the swap has changed from its initial value according to GlobeCorp's perspective and determine which party to the swap has greater current credit risk.

| | Change in swap value | Greater current credit risk |
|---|---|---|
| A. | Increase | GlobeCorp |
| B. | Increase | NVS Bank |
| C. | Decrease | GlobeCorp |
| D. | Decrease | NVS Bank |

56. GlobeCorp is concerned with its exposure to the interest rate swap initiated one year ago. Evaluate the strategies recommended by Bow in Figure 2 and state whether Strategy 1 or Strategy 2 will neutralize GlobeCorp's exposure to the interest rate swap.

| | Strategy 1 | Strategy 2 |
|---|---|---|
| A. | No | No |
| B. | No | Yes |
| C. | Yes | No |
| D. | Yes | Yes |

57. Determine which of the interest rate derivatives in Figure 3 is appropriate to manage the interest rate risk associated with NVS Bank's $100 million debt obligation and calculate the payoff from this derivative 360 days after the contract initiation if LIBOR at that time is expected to be 3.75%.

| | Appropriate derivative | Payoff after 360 days |
|---|---|---|
| A. | Interest Rate Cap | $25,000 |
| B. | Interest Rate Cap | $50,000 |
| C. | Interest Rate Floor | $25,000 |
| D. | Interest Rate Floor | $50,000 |

58. Calculate the expected payoff after 720 days from a short position in the 2-year semiannual interest rate floor in Figure 3 if LIBOR at that time is expected to be 2.40%.
A. –$150,000.
B. –$75,000.
C. $0.
D. $150,000.

59. Which of the following combinations of interest rate derivatives from Figure 3 would effectively limit the maximum and minimum interest cost associated with NVS Bank's $100 million floating rate notes?
   A. Sell a 2-year semiannual settlement interest rate floor and buy a 2-year semiannual settlement interest rate cap.
   B. Buy a 2-year semiannual settlement interest rate floor and sell a 2-year semiannual settlement interest rate cap.
   C. Sell a 2-year quarterly settlement interest rate floor and buy a 2-year quarterly settlement interest rate cap.
   D. Buy a 2-year quarterly settlement interest rate floor and sell a 2-year quarterly settlement interest rate cap.

60. Evaluate Green's comments in her memo to the managers at NVS Bank. State whether Green is *correct* or *incorrect* regarding the effectiveness of the alternative to using an interest rate cap or floor and regarding the effectiveness of creating an artificial interest rate collar.

| | Alternative to cap or floor | Artificial collar |
|---|---|---|
| A. | Correct | Correct |
| B. | Correct | Incorrect |
| C. | Incorrect | Correct |
| D. | Incorrect | Incorrect |

**END OF MORNING SESSION**

54. **B** Terry's justification is incorrect. There are actually more maturity points in the swap market from which a swap curve can be derived. The rest of Terry's statements are correct. Garret has correctly constructed the swap rate curve. Theoretically the swap curve is constructed using the fixed swap rates of varying maturity swaps available today. However, since the fixed rate of a swap is determined using the spot and forward floating rates (in this case LIBOR), the swap curve can be viewed as being equivalent to the LIBOR curve.

**Cross Reference to CFA Institute® Study Session 17, Reading 67 and 68**

55. **D** At the initiation of GlobeCorp's fixed rate payer swap, the value was zero and the fixed rate was set at 2.75%. To determine the change in the value of the swap, we must determine the fixed rate on comparable swaps available today using the LIBOR curve. Since a year has passed since the initiation of the swap, a comparable swap as of today would be a 2-year swap with semiannual payments. First calculate the discount factors for the 180-, 360-, 540-, and 720-day LIBOR interest rates as follows:

$$180\text{-day} = \frac{1}{1+0.0245\left(\frac{180}{360}\right)} = 0.9879; \quad 360\text{-day} = \frac{1}{1+0.0375\left(\frac{360}{360}\right)} = 0.9639;$$

$$540\text{-day} = \frac{1}{1+0.0380\left(\frac{540}{360}\right)} = 0.9461; \quad 720\text{-day} = \frac{1}{1+0.0240\left(\frac{720}{360}\right)} = 0.9542$$

Next calculate the fixed rate currently available on 2-year semiannual pay swaps as follows:

$$\left[\frac{(1-0.9542)}{(0.9879+0.9639+0.9461+0.9542)}\right]\times\left(\frac{360}{180}\right) = 0.0119\times 2 = 0.0238 = 2.38\%$$

GlobeCorp could enter into an equivalent swap today at an annualized fixed rate of 2.38% vs. the fixed rate of 2.75% that it is currently paying on the existing swap. Therefore, the existing swap has negative value to GlobeCorp and has thus decreased from an initial value of zero. Current credit risk is greater for NVS Bank since the negative value of the swap to GlobeCorp increases the chance that the company will default on the obligation and fail to make the required payments to NVS.

56. **C** A payer swap such as GlobeCorp's is obligated to pay multiple fixed rate payments to, and receive multiple floating rate payments from, the counterparty. The payer swap therefore gains (loses) value if interest rates rise (fall) since floating rate payments will be greater (less) than the required fixed rate payments. Similarly, the long position in a forward rate agreement (FRA) allows the purchaser to borrow at a specified rate (pay fixed). If interest rates rise (fall), the long FRA position gains (loses) value. Thus, we can state that a series of long off-market FRAs is equivalent to a pay fixed interest rate swap. To offset an existing pay fixed swap position, a position with opposite exposure to interest rates must be established. Therefore, Strategy 1 is appropriate since it involves a short position in a series of off-market FRA contracts with settlement dates and underlying interest rates that correspond to the swap payment dates (the FRAs are all based on 180-day or 6-month LIBOR and settle in 6 months, 12 months, 18 months, and 24 months). Strategy 2 will not offset GlobeCorp's existing interest rate swap position. A pay fixed interest rate swap position is equivalent to being short a fixed rate bond and long a floating rate bond. In order to neutralize such a position, the opposite transactions need to be established. Strategy 2 correctly states that GlobeCorp should take a short position in a floating rate note but this will only offset half of the swap position. GlobeCorp must also purchase a fixed rate bond with a coupon rate equal to the fixed rate on the swap.

57. **A** NVS Banks is issuing a $100 million floating rate note with quarterly interest rate payments and a maturity of two years to fund its operations. The interest rate risk of such a measure is that interest rates will rise dramatically causing the interest cost on the floating rate note to increase as well. To offset this risk, NVS Bank can take a long position in an interest rate cap. If interest rates rise, the counterparty to the cap will make a payment to NVS Bank. If interest rates fall, no payment is made. Since the cap is a set of interest rate options, NVS has the right to receive

payments if the cap is in the money but will never owe any payments if the cap is out of the money. To obtain this option, NVS must pay the cap premium ($2,200,000). The most appropriate cap is the 2-year quarterly payment cap with a contract rate of 3.65%. The expected payoff after 360 days is determined by comparing the expected LIBOR rate (3.75%) to the contract rate on the cap (3.65%). Since the actual rate is expected to be above the cap rate, the cap is in the money and the payoff is calculated as follows:

$$(0.0375 - 0.0365)\left(\frac{90}{360}\right)(100{,}000{,}000) = \$25{,}000$$

58. **A** The writer or seller of a floor (i.e., the short position) receives the premium or fee from the buyer of the floor. This fee is the maximum gain that the seller can achieve. The seller will be forced to make a payment to the buyer if the floor expires in the money. For a floor to be in the money, the reference rate (LIBOR in this case) must be below the contract rate. The contract rate on the 2-year semiannual floor is 2.70% which is greater than the expected LIBOR rate of 2.40% after 720 days. Therefore, the floor is in the money and the seller must make a payment to the buyer. The payment is calculated as follows:

$$(0.0240 - 0.0270)\left(\frac{180}{360}\right)(100{,}000{,}000) = -\$150{,}000$$

Note that the purchaser of the floor in this scenario would receive a positive $150,000 payoff.

59. **C** An interest rate collar consists of a long interest rate cap and a short interest rate floor. The long cap limits the interest rate exposure on the upside, effectively capping the maximum interest rate the purchaser of the cap will have to pay. The short floor creates exposure to interest rates on the downside, requiring payments as interest rates fall. Because NVS Bank is short a floating rate note, its interest costs should fall with interest rates. However, the short floor limits the degree to which interest expense can fall, effectively limiting the minimum interest payment. The combination of the maximum interest rate and the minimum interest rate creates the collar within which the interest rate may fluctuate. NVS Bank is exposed to quarterly floating rate interest payments for a period of two years. To create an appropriate collar, the bank should purchase the 2-year quarterly settlement cap and sell the 2-year quarterly settlement floor.

60. **B** NVS Bank is concerned that interest rates will rise, increasing the interest expense on their 2-year floating rate notes. To mitigate this risk, an appropriate strategy would be to buy an interest rate cap which would limit the exposure to rising interest rates. Other instruments can replicate the payoffs of a cap, however, if the cap itself is not desirable. An interest rate cap increases in value as interest rates rise since a payoff to the buyer of the cap becomes more probable. Put options on fixed income instruments have a similar response to interest rates. As interest rates rise, the value of the underlying fixed income instruments decreases. Since a put option gives the owner the right to sell a bond that has decreased in price at higher than market value, the value of the option increases as interest rates rise. With the right amount of long put options on fixed income instruments, NVS Bank could replicate the cap payoff without actually buying the cap. Green's first alternative is therefore correct. To create a collar, NVS Bank would need to purchase a cap and sell a floor. Doing so would give NVS protection from rising interest rates and would decrease the cost of gaining such protection. However, a collar would create exposure to decreasing interest rates through the short floor position. A long cap position can be replicated through either long put options on fixed income instruments or long call options on interest rates. A short floor position can be replicated either through short call options on fixed income instruments or short put options on interest rates. Green has correctly stated the long cap position but has incorrectly stated the short floor position. Therefore, the collar replication strategy is incorrect.