PRACTICE PROBLEMS

The following information relates to Questions 1–6

Amy McLaughlin is a fixed-income portfolio manager at UK-based Delphi Investments. One year ago, given her expectations of a stable yield curve over the coming 12 months and noting that the yield curve was upward sloping, McLaughlin elected to position her portfolio solely in 20-year US Treasury bonds with a coupon rate of 4% and a price of 101.7593, with the expectation of selling the bonds in one year at a price of 109.0629. McLaughlin expected the US dollar to depreciate relative to the British pound by 1.50% during the year. McLaughlin chose the 20-year Treasury bonds because they were on the steepest part of the yield curve.

McLaughlin and Michaela Donaldson, a junior analyst at Delphi, are now discussing how to reposition the portfolio in light of McLaughlin's expectations about interest rates over the next 12 months. She expects interest rate volatility to be high and the yield curve to experience an increase in the 2s/10s/30s butterfly spread, with the 30-year yield remaining unchanged. Selected yields on the Treasury yield curve, and McLaughlin's expected changes in yields over the next 12 months, are presented in Exhibit 1.

Exhibit 1 Current Treasury Yield Curve and Forecasted Yields

Maturity (years)	Starting Yield (Current)	Forecasted Change in Yield	Ending Yield
2	1.01%	+0.04%	1.05%
5	1.55%	+0.40%	1.95%
10	2.75%	+0.50%	3.25%
30	3.50%	+0.00%	3.50%

Based on these interest rate expectations, McLaughlin asks Donaldson to recommend a portfolio strategy. Donaldson considers the following three options.

Bullet portfolio: Invest solely in 10-year Treasury government bonds

Barbell portfolio: Invest solely in 2-year and 30-year Treasury government bonds

Laddered portfolio: Invest equally in 2-year, 5-year, 10-year, and 30-year Treasury government bonds

After recommending a portfolio strategy, McLaughlin tells Donaldson that using a duration-neutral, long/short structure may be a better strategy for attempting to enhance portfolio return. McLaughlin suggests that Donaldson consider a butterfly trade or a condor trade using some combination of 2-year, 5-year, 10-year, and 30-year bonds.

Donaldson suggests they also consider altering the portfolio's convexity to enhance expected return given McLaughlin's interest rate expectations. Donaldson tells McLaughlin the following.

Statement 1 Portfolios with larger convexities often have higher yields.

Statement 2 If yields rise, a portfolio of a given duration with higher convexity will experience less of a price decrease than a similar-duration, lower-convexity portfolio.

1 The portfolio strategy implemented by McLaughlin last year is *mostly likely* to be described as:

A a carry trade.

B a barbell structure.

C riding the yield curve.

2 At the start of last year, the expected return on the portfolio strategy implemented by McLaughlin was *closest* to:

A 9.61%.

B 9.68%.

C 12.61%.

3 Using the yield curve forecast shown in Exhibit 1, which portfolio strategy should Donaldson recommend for the year ahead?

A The bullet portfolio

B The barbell portfolio

C The laddered portfolio

4 Given McLaughlin's interest rate expectations over the next 12 months, which long/short structure would be most appropriate?

A Condor: short wings, long body

B Butterfly: short barbell, long bullet

C Butterfly: long barbell, short bullet

5 Given McLaughlin's interest rate expectations over the next 12 months, one way that Donaldson and McLaughlin could alter convexity to enhance expected return would be to:

A sell call options on bonds held in the portfolio.

B buy call options on long-maturity government bond futures.

C sell put options on bonds they would be willing to own in the portfolio.

6 Which of Donaldson's statements is correct?

A Only Statement 1

B Only Statement 2

C Both Statements 1 and 2

The following information relates to questions 7–14

Sanober Hirji is a junior analyst with Northco Securities, which is based in Canada. The institutional clients of Northco are active investors in Canadian coupon-bearing government bonds. Client portfolios are benchmarked to a Canadian government bond index, which is a diverse maturity index portfolio. After reviewing the portfolio of a French institutional client, Hirji evaluates yield curve strategies for Canadian government bond portfolios under various interest rate scenarios. Hirji's supervisor, Éliane Prégent, forecasts that Canadian long-term rates will rise and short-term rates will fall over the next 12 months.

In contrast, Northco's chief economist forecasts that Canadian interest rates will increase or decrease by 100 basis points over the next 12 months. Based on the chief economist's forecast, Hirji suggests increasing the convexity of the French institutional client's portfolio by selling 10-year bonds and investing the proceeds in a duration-matched barbell position of Canadian government 3-year and long-term bonds. She notes that the duration of the 10-year bonds, along with the durations of the other portfolio bonds, aligns the portfolio's effective duration with that of the benchmark. Selected data on Canadian government bonds are presented in Exhibit 1.

Exhibit 1 Canadian Government Bonds As of 1 January

Security	Effective Duration	Effective Convexity
1-year	0.99	0.007
3-year	2.88	0.118
10-year	9.51	0.701
Long-term	21.30	2.912

* There is no single convention for how convexity numbers are presented; for example, Bloomberg has historically followed a convention of dividing the "raw" convexity number by 100 (as presented here). However, it is important to use the raw convexity number when estimating returns.

Hirji then considers a strategy to sell some long-term bonds from the French institutional client's portfolio and purchase short maturity at-the-money options on long-term bond futures. The portfolio's duration would remain unchanged. Prégent asks:

> "How would portfolio performance be affected by this strategy if the yield curve were to remain stable?"

Hirji also proposes the following duration-neutral trades for the French institutional client:

- Long/short trade on 1-year and 3-year Canadian government bonds
- Short/long trade on 10-year and long-term Canadian government bonds

Six months later, Hirji reviews Canadian government bonds for a Malaysian institutional client. Prégent and Hirji expect changes in the curvature of the yield curve but are not sure whether curvature will increase or decrease. Hirji first analyzes positions that would profit from an increase in the curvature of the yield curve. The positions must be duration neutral, and the maximum position that the Malaysian client can take in long-term bonds is C$150 million. Hirji notes that interest rates have increased by 100 basis points over the past six months. Selected data for on-the-run Canadian government bonds are shown in Exhibit 2.

Exhibit 2 On-the-Run Canadian Government Bonds As of 1 July

Maturity	YTM (%)	Duration	PVBP (C$ millions)
2-year	1.73	1.97	197
5-year	2.01	4.78	478
10-year	2.55	8.89	889
Long-term	3.16	19.60	1,960

Hirji then considers the scenario where the yield curve will lose curvature for the Malaysian institutional client. She notes that a 7-year Canadian government bond is also available in the market. Hirji proposes a duration-neutral portfolio comprised of 47% in 5-year bonds and 53% in 7-year bonds.

Finally, Hirji uses the components of expected returns to compare the performance of a bullet portfolio and a barbell portfolio for a British institutional client. Characteristics of these portfolios are shown in Exhibit 3.

Exhibit 3 Characteristics of Bullet and Barbell Portfolios

	Bullet Portfolio	Barbell Portfolio
Investment horizon (years)	1.0	1.0
Average annual coupon rate for portfolio	1.86%	1.84%
Average beginning bond price for portfolio	C$100.00	C$100.00
Average ending bond price for portfolio (assuming rolldown and stable yield curve)	C$100.38	C$100.46
Current modified duration for portfolio	4.96	4.92
Expected effective duration for portfolio (at the horizon)	4.12	4.12
Expected convexity for portfolio (at the horizon)	14.68	24.98
Expected change in government yield curve	–0.55%	–0.55%

7 Based on Prégent's interest rate forecast over the next 12 months, the yield curve strategy that would *most likely* realize the highest profit is:

A a carry trade.

B a bullet structure.

C duration management by buying long-term Canadian bonds.

8 Based on Exhibit 1, the gain in convexity from Hirji's suggestion is *closest* to:

A 0.423.

B 1.124.

C 1.205.

9 The answer to Prégent's question is that the portfolio would *most likely* experience:

A a loss.

B no change.

C a gain.

10 Which yield curve forecast will *most likely* result in the highest profit for Hirji's proposed duration-neutral trades?

A Increase in curvature

B Decrease in curvature

C Parallel downward shift

11 Based on Exhibit 2, the amount that Hirji should allocate to the 2-year bond position is *closest* to:

A C$331 million.

B C$615 million.

C C$1,492 million.

12 Relative to the Canadian government bond index, the portfolio that Hirji proposes for the Malaysian client will *most likely*:

A underperform.

B remain stable.

C outperform.

13 Based on Exhibit 3, the difference in the rolling yield between Hirji's bullet portfolio and barbell portfolio is:

A –8 basis points.

B –6 basis points.

C 2 basis points.

14 Based on Exhibit 3, the total expected return of Hirji's barbell portfolio is *closest* to:

A –2.30%.

B 0.07%.

C 4.60%.

The following information relates to questions 15–22

Silvia Abram and Walter Edgarton are analysts with Cefrino Investments, which sponsors the Cefrino Sovereign Bond Fund (the Fund). Abram and Edgarton recently attended an investment committee meeting where interest rate expectations for the next 12 months were discussed. The Fund's mandate allows its duration to fluctuate ±0.30 per year from the benchmark duration. The Fund's duration is currently equal to its benchmark. Although the Fund is presently invested entirely in annual coupon sovereign bonds, its investment policy also allows investments in mortgage-backed securities (MBS) and call options on government bond futures. The Fund's current holdings of on-the-run bonds are presented in Exhibit 1.

Exhibit 1 Cefrino Sovereign Bond Fund Current Fund Holdings of On-the-Run Bonds

Maturity	Coupon/YTM	Market Value	Modified Duration
1-year	0.78%	$10,000,000	0.99
3-year	1.40%	$10,000,000	2.92
5-year	1.80%	$10,000,000	4.74
10-year	2.34%	$10,000,000	8.82
30-year	2.95%	$10,000,000	19.69
Portfolio	1.85%	$50,000,000	7.43

Over the next 12 months, Abram expects a stable yield curve; however, Edgarton expects a steepening yield curve, with short-term yields rising by 1.00% and long-term yields rising by more than 1.00%.

Based on her yield curve forecast, Abram recommends to her supervisor changes to the Fund's holdings using the following three strategies:

Strategy 1: Sell the 3-year bonds, and use the proceeds to buy 10-year bonds.

Strategy 2: Sell the 5-year bonds, and use the proceeds to buy 30-year MBS with an effective duration of 4.75.

Strategy 3: Sell the 10-year bonds, and buy call options on 10-year government bond futures.

Abram's supervisor disagrees with Abram's yield curve outlook. The supervisor develops two alternative portfolio scenarios based on her own yield curve outlook:

Scenario 1 Sell all bonds in the Fund except the 2-year and 30-year bonds, and increase positions in these two bonds while keeping duration neutral to the benchmark.

Scenario 2 Construct a condor to benefit from less curvature in the 5-year to 10-year area of the yield curve. The condor will utilize the same 1-year, 5-year, 10-year, and 30-year bonds held in the Fund. The maximum allowable position in the 30-year bond in the condor is $17 million, and the bonds must have equal (absolute value) money duration.

Edgarton evaluates the Fund's positions from Exhibit 1 along with two of his pro forma portfolios, which are summarized in Exhibit 2:

Exhibit 2 Selected Partial Durations

Maturity	Beginning Yield Curve	Curve Shift	Current Portfolio Partial PVBP	Pro Forma Portfolio 1 Partial PVBP	Pro Forma Portfolio 2 Partial PVBP
1-year	0.78%	1.00%	0.0020	0.0018	0.00210
3-year	1.40%	1.00%	0.0058	0.0044	0.00610
5-year	1.80%	1.25%	0.0095	0.0114	0.00950
10-year	2.34%	1.60%	0.0177	0.0212	0.01590
30-year	2.95%	1.75%	0.0394	0.0374	0.03940

Lastly, Edgarton reviews a separate account for Cefrino's US clients that invest in Australian government bonds. He expects a stable Australian yield curve over the next 12 months. He evaluates the return from buying and holding a 1-year Australian government bond versus buying the 2-year Australian government bond and selling it in one year.

Exhibit 3 Cefrino Australian Government Bond Portfolio Assumptions for Stable Yield Curve

	Portfolio Strategies	
	Buy-and-Hold Portfolio	**Ride-the-Yield Curve Portfolio**
Investment horizon (years)	1.0	1.0
Bonds maturity at purchase (years)	1.0	2.0
Coupon rate	1.40%	1.75%
Yield to maturity	1.65%	1.80%
Current average portfolio bond price	A$99.75	A$99.90
Expected average bond price in one year for portfolio	A$100.00	A$100.10
Expected currency gains or losses	–0.57%	–0.57%

15 Based on Exhibit 1 and Abram's expectation for the yield curve over the next 12 months, the strategy *most likely* to improve the Fund's return relative to the benchmark is to:

A buy and hold.

B increase convexity.

C ride the yield curve.

16 Based on Edgarton's expectation for the yield curve over the next 12 months, the Fund's return relative to the benchmark would *most likely* increase by:

A riding the yield curve.

B implementing a barbell structure.

C shortening the portfolio duration relative to the benchmark.

17 Based on Exhibit 1 and Abram's interest rate expectations, which of the following strategies is expected to perform *best* over the next 12 months?

A Strategy 1

B Strategy 2

C Strategy 3

18 The yield curve expectation that Abram's supervisor targets with Scenario 1 is *most likely* a:

A flattening yield curve.

B reduction in yield curve curvature.

C 100 bps parallel shift downward of the yield curve.

19 Based on Exhibit 1, which short position is *most likely* to be included in the condor outlined in Scenario 2?

A 1-year $338 million

B 5-year $71 million

C 10-year $38 million

20 Based on Exhibits 1 and 2, which of the following portfolios is *most likely* to have the *best* performance given Edgarton's yield curve expectations?

A Current Portfolio

B Pro Forma Portfolio 1

C Pro Forma Portfolio 2

21 Based on Exhibit 3, the 1-year expected return of the Buy-and-Hold portfolio for the Cefrino Australian government bond portfolio is *closest* to:

A 0.83%.

B 1.08%.

C 2.22%.

22 Based on Exhibit 3, the implied Australian dollar (A$) 1-year rate, 1-year forward is *closest* to:

A 0.15%.

B 1.95%.

C 2.10%.

SOLUTIONS

1 C is correct. Last year, McLaughlin expected the yield curve to be stable over the year. Riding the yield curve is a strategy based on the premise that, as a bond ages, it will decline in yield if the yield curve is upward sloping. This is known as "roll down"; that is, the bond rolls down the (static) curve. Riding the yield curve differs from buy and hold in that the manager is expecting to add to returns by selling the security at a lower yield at the horizon. This strategy may be particularly effective if the portfolio manager targets portions of the yield curve that are relatively steep and where price appreciation resulting from the bond's migration to maturity can be significant. McLaughlin elected to position her portfolio solely in 20-year Treasury bonds, which reflect the steepest part of the yield curve, with the expectation of selling the bonds in one year.

2 A is correct. The expected return on the strategy (riding the curve) is calculated as follows.

$E(R)$	≈	Yield income	(equal to Annual coupon rate/Current bond price)
	+	Rolldown return	[equal to (End bond price – Begin bond price)/Begin bond price]
	+	E(Change in price based on investor's views of yields and yield spreads)	
	–	E(Credit losses)	
	+	E(Currency gains or losses)	

Return Component	Formula*	Portfolio Performance
Yield income	Annual coupon payment/Current bond price	4/101.7593 = 3.93%
+ Rolldown return	$\frac{(\text{Bond price}_{\text{End-of-horizon}} - \text{Bond price}_{\text{Beginning-of-horizon}})}{\text{Bond price}_{\text{Beginning-of-horizon}}}$	(109.0629 – 101.7593)/101.7593) = 7.18%
+ E(Change in price based on investor's views of yields and yield spreads)		0%
= Rolling yield	Yield income + Rolldown return	3.93% + 7.18% = 11.11%
– E(Credit losses)	N/A	–0%
+ E(Currency gains or losses)	Given	–1.50%
= Total expected return		= 9.61%

In this case, the E(Change in price based on investor's views of yields and yield spreads) term is equal to zero because McLaughlin expects the yield curve to remain stable.

3 B is correct. McLaughlin expects the yield curve to experience an increase in the butterfly spread, with the 30-year yield remaining unchanged, which implies that the yield curve will increase its curvature, pinned at the 30-year yield, as shown in Exhibit 1. The barbell portfolio, consisting of 2-year and 30-year bonds, would be expected to perform best. Although the two-year rate is expected to increase, the effective duration of two-year bonds is quite small, resulting in minimal price impact. Similarly, the 30-year yield is expected to remain constant, resulting in minimal price impact as well. Relative to the

barbell portfolio, the laddered portfolio has greater exposure to the expected increases in the 5-year and 10-year yields, and the bullet portfolio has greater exposure to the expected increase in the 10-year yield. Therefore, the barbell portfolio would be expected to perform best given McLaughlin's interest rate expectations.

4 C is correct. McLaughlin expects interest rate volatility to be high and the yield curve to experience an increase in the butterfly spread, with the 30-year yield remaining unchanged. Given these expectations, a long barbell (2s and 30s, short bullet [10s] butterfly trade would be most appropriate. The two-year yield is expected to slightly increase by 0.04%, resulting in minimal price impact given the relatively low duration of two-year bonds. Similarly, the 30-year yield is expected to remain constant, resulting in minimal price impact as well. The 10-year yield (+0.50%) is expected to increase by more than the 5-year yield (+0.40%), and with its higher effective duration, the 10-year would be appropriate for the short bullet part of the butterfly trade.

5 B is correct. McLaughlin expects interest rate volatility to be high and the yield curve to experience an increase in the butterfly spread, with the 30-year yield remaining unchanged. To increase the portfolio's expected return, Donaldson and McLaughlin should buy call options on long-maturity government bond futures to increase convexity.

6 B is correct. Statement 2 is correct: If yields rise, a portfolio of a given duration with higher convexity will experience less of a price decrease than a similar-duration, lower-convexity portfolio. Statement 1 is incorrect, as portfolios with larger convexities often have lower yields. Investors will be willing to pay for increased convexity when they expect yields to change by more than enough to cover the sacrifice in yield.

7 B is correct. A bullet performs well when the yield curve is expected to steepen. Since Prégent's forecast is for long rates to rise and short rates to fall, this strategy will add value to the French client's portfolio by insulating the portfolio against adverse moves at the long end of the curve. If short rates fall, the bullet portfolio gives up very little in profits given the small magnitude of price changes at the short end of the curve.

8 A is correct. To maintain the effective duration match, the duration of the 10-year bond sale must equal the total weighted duration of the 3-year and long-term bond purchases.

$$\begin{aligned} 9.51 &= (\text{Duration of 3-year bond} \times \text{Weight of 3-year bond}) + (\text{Duration of long-term bond} \times \text{Weight of long-term bond}) \\ x &= \text{weight of 3-year bond} \\ (1 - x) &= \text{weight of long-term bond} \\ 9.51 &= 2.88x + 21.30(1 - x) \\ x &= 0.64 \text{ or } 64\% \end{aligned}$$

The proceeds from the sale of the 10-year Canadian government bond should be allocated 64% to the 3-year bond and 36% to the long-term bond:

$$9.51 = (64\% \times 2.88) + (36\% \times 21.30)$$

$$\begin{aligned} \text{Gain in convexity} &= (\text{Weight of the 3-year}) \times (\text{Convexity of the 3-year}) + (\text{Weight of the long-term bond}) \times (\text{Convexity of the long-term bond}) - (\text{Weight of the 10-year}) \times (\text{Convexity of the 10-year}) \\ \text{Gain in convexity} &= (64\% \times 0.118) + (36\% \times 2.912) - (100\% \times 0.701) = 0.42284 \text{ or } 0.423 \end{aligned}$$

9 A is correct. Short maturity at- or near-the-money options on long-term bond futures contain a great deal of convexity. Thus, options increase the convexity of the French client's portfolio. Options are added in anticipation of a significant change in rates. If the yield curve remains stable, the portfolio will experience a loss from both the initial purchase price of the options and the foregone interest income on the liquidated bonds.

10 A is correct. The trades are also called a condor and employ four positions, much like a butterfly with an elongated body. Each pair of duration-neutral trades would result in a profit if the yield curve adds curvature. The trades at the short end of the curve (going long the 1-year bond and short the 3-year bond) would profit if that end of the curve gets steeper. In addition, the trades at the long end of the curve (going short the 10-year bond and long the long-term bond) would profit if that end of the curve becomes flatter.

11 C is correct. In order to take duration-neutral positions that will profit from an increase in the curvature of the yield curve, Hirji should structure a condor. This condor structure has the following positions: long the 2-year bonds, short the 5-year bonds, short the 10-year bonds, and long the long-term bonds. Hirji's allocation to the 2-year bond position is calculated as follows:

The C$150 million long-term bonds have a money duration of C$150 × 1,960 = C$294,000

Allocation to 2-year bond = Money duration of long-term bonds/PVBP of 2-year bond

2-year bond position = C$294,000/197 = 1,492.39 or C$1,492 million

12 C is correct. Hirji proposes an extreme bullet portfolio focusing on the middle of the yield curve. If the forecast is correct and the yield curve loses curvature, the rates at either end of the curve will rise or the intermediate yields will drop. As a result, bonds at the ends of the yield curve will lose value or the intermediate bonds will increase in value. In either case, the bullet portfolio will outperform relative to a more diverse maturity index portfolio like the benchmark.

13 B is correct. The rolling yield of the two portfolios is calculated as follows:

Return Component	Formula	Bullet Portfolio	Barbell Portfolio
Yield income	Annual coupon payment/Current bond price	1.86/100.00 = 1.86%	1.84/100.00 = 1.84%
+ Rolldown return	(Bond price$_{eh}$ – Bond price$_{bh}$)/Bond price$_{bh}$	(100.38 – 100.00)/100.00 = 0.38%	(100.46 – 100.00)/100.00 = 0.46%
= Rolling yield	Yield income + Rolldown return	= 2.24%	= 2.30%

Difference in Rolling yield = Rolling yield of the bullet portfolio – Rolling yield of the barbell portfolio

2.24% – 2.30% = –0.06% or –6 basis points

14 C is correct. The total expected return is calculated as follows:

Return Component	Formula	Barbell Return (C)	Distractor A	Distractor B
Yield income	Annual coupon payment/ Current bond price	1.84/100.00 = 1.84%	1.84/100.00 = 1.84%	1.84/100.00 = 1.84%
+ Rolldown return	(Bond price$_{eh}$ – Bond price$_{bh}$)/ Bond price$_{bh}$	(100.46 – 100.00)/100.00 = 0.46%	(100.46 – 100.00)/100.00 = 0.46%	(100.46 – 100.00)/100.00 = 0.46%

(continued)

Return Component	Formula	Barbell Return (C)	Distractor A	Distractor B
= Rolling yield	Yield income + Rolldown return	= 2.30%	= 2.30%	= 2.30%
+ E(change in price based on yield view)	$(-MD_{eh} \times \Delta yield) + [½ \times Convexity \times (\Delta yield)^2]$	$[-4.12 \times -0.55\%] + [½ \times 24.98 \times (-0.55\%)^2]$ = 2.30%	$[-4.12 \times -0.55\%] + [½ \times 24.98 \times (-0.55\%)]$ = −4.60%	$[4.12 \times -0.55\%] + [½ \times 24.98 \times (-0.55\%)^2]$ = −2.23%
= Total expected return		**= 4.60%**	= −2.30%	= 0.07%

15 C is correct. Since Abram expects the curve to remain stable, the yield curve is upward sloping and the Fund's duration is neutral to its benchmark. Her best strategy is to ride the yield curve and enhance return by capturing price appreciation as the bonds shorten in maturity.

16 C is correct. If interest rates rise and the yield curve steepens as Edgarton expects, then shortening the Fund's duration from a neutral position to one that is shorter than the benchmark will improve the portfolio's return relative to the benchmark. This duration management strategy will avoid losses from long-term interest rate increases.

17 B is correct. In a stable yield curve environment, holding bonds with higher convexity negatively affects portfolio performance. These bonds have lower yields than bonds with lower convexity, all else being equal. The 5-year US Treasury has higher convexity than the negative convexity 30-year MBS bond. So, by selling the 5-year Treasury and purchasing the 30-year MBS, Abram will reduce the portfolio's convexity and enhance its yield without violating the duration mandate versus the benchmark.

18 A is correct. Scenario 1 is an extreme barbell and is typically used when the yield curve flattens. In this case, the 30-year bond has larger price gains because of its longer duration and higher convexity relative to other maturities. If the yield curve flattens through rising short-term interest rates, portfolio losses are limited by the lower price sensitivity to the change in yields at the short end of the curve while the benchmark's middle securities will perform poorly.

19 A is correct. To profit from a decrease in yield curve curvature, the correct condor structure will be: short 1s, long 5s, long 10s, and short 30s. The positions of the condor will be: short $338 million 1-year bond, long $71 million 5-year bond, long $38 million 10-year bond, and short $17 million 30-year bond.

This condor is structured so that it benefits from a decline in curvature, where the middle of the yield curve decreases in yield relative to the short and long ends of the yield curve.

To determine the positions, we take the maximum allowance of 30-year bonds of $17 million and determine money duration. Money duration is equal to market value x modified duration divided by 100. 30-year bond money duration = $17 million × 19.69/100 = $3,347,300. The market values of the other positions are:

1-year bond: $3,347,300 × 100/0.99 = $338.11 million or $338 million

5-year bond: $3,347,300 × 100/4.74 = $70.62 million or $71 million

10-year bond: $3,347,300 × 100/8.82 = $37.95 million or $38 million

20 C is correct. Given Edgarton's expectation for a steepening yield curve, the best strategy is to shorten the portfolio duration by more heavily weighting shorter maturities. Pro Forma Portfolio 2 shows greater partial duration in the 1- and

3-year maturities relative to the current portfolio and the least exposure in the 10- and 30-year maturities of the three portfolios. The predicted change is calculated as follows:

Predicted change = Portfolio par amount × partial PVBP × (curve shift in bps)/100

21 B is correct. The total expected return is calculated as:

Total expected return = Yield income + Rolldown return = Rolling yield + E (currency gains or losses).

Return Component	Formula	Buy-and-Hold Portfolio Performance
Yield income	Annual coupon payment/Current bond price	1.40/99.75 = 1.40%
+ Rolldown return	(Bond price$_{\text{end of horizon}}$ − Bond price$_{\text{beginning of horizon}}$) ÷ Bond price$_{\text{beginning of horizon}}$	(100 − 99.75)/99.75 = 0.25%
= Rolling yield	Yield income + Rolldown return	1.40 + 0.25 = 1.65%
+ E (currency gains or losses)	Given	–0.57%
= Total expected return		1.08%

22 B is correct. The implied forward rate can be calculated using the yield to maturity (YTM) of the 2-year Ride-the-Yield Curve and 1-year Buy-and-Hold portfolios.

$F_{1,1} = [(1.018)^2/1.0165] - 1 = 1.95\%$