Set 1 Questions

1. Which of the following statements about arbitrage pricing theory (APT) is *most likely* true?
   A. APT represents an asset's risk as a linear function of factors representing unsystematic risk.
   B. The number of underlying factors in APT is fixed.
   C. A key assumption of APT is that there are many investable assets such that asset specific risk can be diversified.

2. An arbitrage opportunity is:
   A. a transaction that generates a risk-free return as a guaranteed pay-off.
   B. a transaction that is risk-free and requires no net investment of money but earns an expected positive net profit.
   C. a transaction that earns a return in excess of the risk-free rate with minimal risk.

3. The one year futures of DMX Co. are selling at $11. The current stock price is $10 and the risk-free rate is 8%. There are no further costs or benefits of holding the future contracts. John Harper is considering shorting futures. Which of the following statements is *most likely* true?
   A. There exists an arbitrage opportunity as the transaction will yield a return higher than the risk-free rate without assuming any risk.
   B. There is no arbitrage opportunity because the transaction does not yield a return higher than the risk-free rate.
   C. There is no arbitrage opportunity because the transaction is not risk-free.

4. The following table shows the factor sensitivities and expected returns of three well-diversified portfolios each sensitive to the same factor:

Portfolio	**Factor Sensitivity**	**Expected Return**
A	0.5	6.5%
B	-0.6	3.2%
C	0.7	7.1%

   Assuming a single factor explains returns and no arbitrage opportunity exists, a risk-free rate of 5%, the factor risk premium of is *closest* to:
   A. 3.0%.
   B. 5.1%.
   C. 11.4%.

5. Belta Inc. has an expected return of 9%. The risk-free rate is 3%. The only factor representing systematic risk is Factor X with an expected return of 5%. The company's sensitivity to Factor X is *closest* to:
   A. 0.0
   B. 1.2
   C. 1.0

6. Which of the following statements regarding multifactor models is *most likely* true?

A. Fundamental factor models present sensitivities of the company to external economic factors that affect its fundamentals
B. Factor analysis models and principal component models are instances of fundamental factor models
C. Macro-economic factor model includes factors such as interest rates and inflation

7. A potential difference between macroeconomic factor models and fundamental factor models is that:
   A. macroeconomic factor models explain past returns whereas fundamental factor models explain expected return.
   B. macroeconomic factor models use regression to estimate sensitivities whereas fundamental factor models do not use regression.
   C. in macroeconomic models the factor is stated as a surprise whereas in fundamental factor models the factor is stated as a return.

8. Active risk is due to:
   A. different-from-benchmark exposures relative to factors specified in the risk model only.
   B. different-from-benchmark weights on individual assets only.
   C. both different-from-benchmark exposures to factors in the model and different-from-benchmark weights of individual assets.

9. The active risk decomposition of two portfolios, A and B is given below:

Portfolio	**Active Factor**		**Active Specific**
	Industry	**Style factor**	
A	15	10	17
B	5	8	2

Note: Entries are in % squared

Which of the following statements is *most likely* true?
   A. Style factor contributed more to Portfolio B's active risk than Portfolio A.
   B. Portfolio B's active risk is higher than that of portfolio A.
   C. The low active specific risk of portfolio B suggests a passively managed portfolio.

10. The track record of three fund managers is given below:

	Average Active return	**Tracking Error**
Fund Manager A	5%	2%
Fund Manager B	2%	1%
Fund Manager C	6%	4%

Based on the data, which fund manager has the best risk-adjusted record?
   A. Fund Manager A.
   B. Fund Manager B.
   C. Fund Manager C.

11. Which of the following statements regarding multifactor models is *most* likely true?
   A. Multifactor models can be used to predict alpha in passively managed portfolios.
   B. Factor models have sensitivity of -1 to a particular factor and 0 to all other factors.

C. Multifactor models can be used to replicate a benchmark's risk exposures for a passively managed portfolio.

12. Which of the following is *least likely* a benefit of using multifactor models in modeling asset returns?
    A. Investors can better analyze their comparative advantage in bearing risk.
    B. Investors can achieve better-diversified portfolios.
    C. Investors can determine the optimum allocation between a risk-free asset and market portfolio.

Set 1 Solutions

1. **C** is correct. APT explains an asset's return based on factors representing systematic risk only. It assumes that asset specific risk can be diversified away. Section 3. LO.a.

2. **B** is correct. An arbitrage opportunity is an opportunity to conduct a transaction that is risk-free and requires no net investment of money but earns an expected positive net profit. Section 3. LO.b.

3. **A** is correct. Buying the stock and shorting the futures gives a guaranteed return of 10% i.e. 11/10 -1 = 10%. The R_F rate is 8%. The transaction gives a pay-off, i.e. risk-free. As the expected return is higher than the R_F rate, an arbitrage opportunity exists. Section 3. LO.b.

4. **A** is correct. Because the single factor explains returns, $E(R_p) = R_F + 0.5$ x factor risk premium (λ) given $E(R_A) = 0.065 = 0.05 + 0.5(\lambda)$. $\lambda = (0.065 - 0.05)/0.5 = 0.03 = 3\%$. Section 3. LO.c.

5. **B** is correct. 9% = 3% + (Factor sensitivity x 5%). Factor sensitivity is therefore 1.2. Section 3. LO.c.

6. **C** is correct. Macroeconomic models represent asset returns correlated to surprises in some factors related to macroeconomic variables. These include interest rates, inflation risk, business cycle risk, GDP growth etc. Section 4.1. LO.d.

7. **C** is correct. In macro-economic models, the factor is stated as a surprise whereas in fundamental factor models the factor is stated as a return. Section 4.3. LO.d.

8. **C** is correct. Active risk has two components: 1) active factor risk which is the risk due to portfolio's different-from-benchmark exposures relative to factors specified in the risk model and 2) asset selection risk which is the risk resulting from the portfolio's active weights of individual assets. Section 5.2. LO.e.

9. **A** is correct. Style contributed 10/42 = 23.8% to portfolio A's active risk and 8/15=53.3% to portfolio B's active risk. Section 5.2. LO.e.

10. **A** is correct. Fund Manager A's IR (information ratio) is 5/2 = 2.5, Fund Manager B's IR is 2/1 = 2 and Fund Manager C's IR is 6/4 = 1.5. Fund Manager A has the highest IR. Section 5.2. LO.e.

11. **C** is correct. Multifactor models can be used to replicate risk exposures of a benchmark for a passively managed portfolio when number of stocks in a benchmark may be too high or investing in all stocks is not possible. Section 5.3. LO.f.

12. **C** is correct. Multifactor models do not provide an optimum allocation rather they are used to understand the varying sources of risk in a portfolio. This can lead to more efficient portfolios. Section 5.4. LO.g.

Set 2 Questions

The following information relates to questions 1 - 4.

Brie Lars is a portfolio manager for Mega Inc., an appliance manufacturer. At the quarterly meeting with the client, Brie explains that she uses multifactor models as a guide to asset allocation. In particular she uses the arbitrage pricing theory (APT) to model asset return. She describes the three main assumptions of the APT model:

Assumption 1: A factor model can be used to explain asset returns.
Assumption 2: No arbitrage opportunities are possible in a well-diversified portfolio.
Assumption 3: Adding assets to a diversified portfolio, adds to factor risk and to its specific risk.

She explains that she evaluates different funds in the market and seeks to exploit arbitrage opportunities among them. She presents an example of different portfolios using a one-factor model that explains returns. The data is presented below:

Exhibit 1: Portfolio information for a one-factor model

Portfolio	Expected return	Factor sensitivity
A	15.0%	0.8
B	16.0%	1.0
C	19.0%	1.2

1. Which of Brie's assumptions underlying APT is *least likely* correct?
   A. Assumption 1.
   B. Assumption 2.
   C. Assumption 3.

2. Based on Exhibit 1, can an arbitrage portfolio be created with a combination of portfolios A, B and C?
   A. No.
   B. Yes, the portfolio would earn an expected return of 1.0%.
   C. Yes, the portfolio would earn an expected return of 17.0%.

3. Assuming that portfolio A and B's returns are represented by a single-factor equation of $E(R_p) = RF + \lambda_1\beta_p$, the value of λ_1 is *closest* to:
   A. 0.05.
   B. 0.025.
   C. 0.010.

4. Based on its factor sensitivity, portfolio B can be *best* characterized as:
   A. an arbitrage portfolio.
   B. a market-neutral portfolio.
   C. a pure factor portfolio.

The following information relates to questions 5 - 8.

Delta partners is an investment management firm which manages portfolios for high net-worth individuals. The firm uses multifactor models to explain asset returns. In a meeting with the investment committee, Simon William, a senior portfolio manager at the firm, explains that he uses a four-factor model with factors for the market (denoted as RMRF), market capitalization (small minus big, or SMB), book value effect (high minus low, or HML), and momentum (winners minus losers, or WML). He has estimated the risk premiums for these factors and estimated factor sensitivities for three portfolios, as shown in Exhibit 2.

Exhibit 2: Factor risk premiums and portfolio sensitivities

Factor	Factor risk premium	Portfolio 1 sensitivities	Portfolio 2 sensitivities	Portfolio 3 sensitivities
RMRF	5.1%	0.8	1.0	0.9
SMB	1.4%	1.1	0.2	0.7
HML	-0.8%	0.4	0.6	1.2
WML	0.5%	1.3	0.8	0.8

Simon further elaborates that he also uses different types of multifactor models. While presenting a comparison of multifactor models to the investment committee, he states,

1. "In a macroeconomic factor model, the factors used are the surprises in economic data relative to expectations.
2. In statistical factor models, an asset's sensitivity to a factor is expressed using a standardized beta, the value of the attribute for the asset minus the average value of the attribute across all stocks divided by the standard deviation of the attribute's values across all stocks."

5. Based on the data in Exhibit 2, the portfolio with the highest expected return *most likely* is:
   A. Portfolio 1.
   B. Portfolio 2.
   C. Portfolio 3.

6. The multifactor model given in Exhibit 2 is known as:
   A. The CAPM model.
   B. The Cahart model.
   C. The Fama French model.

7. With regards to Simon's explanation of the macroeconomic factor model, he is *most likely*:
   A. incorrect, because the factors used are the absolute values of the macroeconomic variables.
   B. correct.
   C. incorrect, because macroeconomic factor models are single-factor models.

8. With regards to Simon's explanation of the statistical factor model, he is *most likely*:
   A. correct.
   B. incorrect, because statistical factor models don't use standardized betas.

C. incorrect, because the definition of standardized beta is incorrect.

The following information relates to questions 9 - 12.

Greg Thompson and Marry Johnson are portfolio managers at Cimka Investments. They are having a discussion on evaluating a portfolio's risk adjusted performance and analyzing its risk exposures.

Greg states, "A portfolio's performance can be measured using the information ratio. During the year my portfolio achieved an active return of 2% and had a variance of active returns equal to 36%, I believe the information ratio of 5.6 is quite impressive".

He further adds, "Active return is the sum of each factor's return multiplied by the difference in the portfolio's sensitivity to that factor and the benchmark's sensitivity. Active risk can be decomposed into total factor risk and active specific risk."

Mary then presents a decomposition of the active risk of three portfolios under management given in Exhibit 3.

Exhibit 3: Decomposition of active risk

	Portfolio 1	**Portfolio 2**	**Portfolio 3**
RMRF risk	10%	25%	10%
SMB risk	20%	15%	10%
HML risk	10%	20%	15%
WML risk	15%	15%	5%
Active specific risk	45%	25%	60%

Note: All figures are a percentage of total active risk squared.

9. Greg's statement about the information ratio of his portfolio is *most likely*:
   A. correct.
   B. incorrect, the information ratio is actually 0.33.
   C. incorrect, the information ratio is actually 0.50.

10. With regards to Greg's statement on active return and active risk, he is *most likely* correct with regards to:
   A. active risk only.
   B. active return only.
   C. both active return and active risk.

11. Based on the data provided in Exhibit 3, the total factor risk of Portfolio 1 is *closest* to:
   A. 0.03%
   B. 13.8%
   C. 55.0%

12. Based on the data provided in Exhibit 3, which portfolio is likely to be the *most* diversified?
   A. Portfolio 2.

B. Portfolio 3.
C. Portfolio 1.

The following information relates to question 13.

Bilal Ahmed, a senior portfolio manager at SLIC Investments is an active manager who constructs the portfolio by overweighting sectors he believes will outperform the market. Ahmed uses a macroeconomic factor model to evaluate sector sensitivity to macro factors. SLIC is confident about its macro forecasting and assumes no error in the forecast.

During a meeting with the chief investment officer of the Aero Corporation's employees' pension fund, Ahmed shows SLIC's macro and micro forecasts (in Exhibit 1) for the technology sector, which he prepared to help explain the firm's investment process.

Exhibit 1

SLIC's Macro Forecasts			
Sector	**Security**	**Sensitivity to Inflation Surprise**	**Sensitivity to GDP Surprise**
Technology	ATEL Networks	0.10	0.30
	Zstr Semiconductor	0.20	0.00
Risk-free rate		4.0%	
SLIC's Micro Forecasts			
	Beta	Expected Return	
ATEL Networks	1.20	15%	
Zstr Semiconductor	1.30	18%	

13. Assuming the inflation surprise is 1.5% and the GDP surprise is 0%, the expected return for the technology sector (using equally weighted securities) would be *closest* to:
    A. 15.2%.
    B. 16.7%.
    C. 20.0%.

The following information relates to questions 14 – 16.

Ann Wiley, is a portfolio manager at Brooks Capital, a firm providing investment consulting and portfolio management services to institutional clients. Wiley is meeting with a new assistant, Paula Slater. Wiley begins the meeting with the following comment:

Comment 1: "We evaluate securities using multifactor models to determine the expected return and risk of securities. Depending on our requirement, we choose one from the three types of multifactor models: a macroeconomic factor model, a fundamental factor model, or a statistical factor model. For macroeconomic factor models, the factors are the surprises in the selected macroeconomic variables. For fundamental factor models, the factors are cross-sectional differences in companies' returns. In statistical factor models, we apply statistical techniques, such as factor analysis or principal component analysis, to historical securities' returns to identify factors that best explain historical variances and covariances."

Slater states: "What is the return generating process given by the arbitrage pricing theory (APT) equation which is also a form of a multifactor model?"

Wiley responds, "APT specifies the appropriate number of factors to use in a multifactor model, helps identify those factors, and gives the expected return of the asset being evaluated."

Wiley continues:
Comment 2: "Multifactor models are also used to explain the active risk of a portfolio. In analyzing risk, using active risk squared can be decomposed into two components: active factor risk and active specific risk. Active factor risk is due to portfolio's different-from-benchmark exposures relative to factors specified in the risk model. Active specific risk measures the residual risk of the portfolio."

14. Wiley is *least likely* correct with respect to which type of multifactor model:
    A. macroeconomic factors models.
    B. fundamental factor models.
    C. statistical factor models.

15. Wiley's response to Slater is *most likely* correct with respect to:
    A. number of factors.
    B. identity of the factors.
    C. expected return.

16. In Comment 2, does Wiley *correctly* state the active factor risk and active specific risk?
    A. Yes.
    B. No, she is incorrect about active specific risk.
    C. No, she is incorrect active factor risk.

The following information relates to questions 17 – 20.

Yash Aggarwal, an equity portfolio manager for Southeast Investments, is meeting with Satish Jha, senior analyst at the firm, to discuss ways to improve the current research methods of evaluating securities.

Jha begins by stating that multifactor models are very useful in modeling stock returns. He adds, "We are currently using two types of multifactor models that can explain stock returns:

$$R_i = a_i + b_{i1}F_1 + b_{i2}F_2 + .. + b_{ik}F_k + \varepsilon_i$$

Model 1
In this model, stock returns are determined by factors which are surprises in macroeconomic variables such as GDP growth and the level of interest rates.

Model 2
Here, stock returns are a linear function of factors that are company or stock attributes such as price-earnings ratio and market capitalization.

The intercept a_i is interpreted as the expected return to stock in both models, the factor sensitivities b_i are defined differently in the two models."

Aggarwal observes, "A multifactor Arbitrage Pricing Model (APT) is also useful in explaining expected portfolio returns and evaluating portfolio risk exposures." She uses the information given below in Exhibit 1 to illustrate the advantages of the multifactor APT model. The current risk-free rate is 3 percent.

Exhibit 1: Factor Sensitivities and Risk Premia

Risk Factor	**Factor Sensitivities**			**Factor Risk Premium (%)**
	Portfolio X	**Portfolio Y**	**Benchmark**	
Confidence Risk	0.90	0.05	0.60	5.0
Inflation Risk	-0.20	-0.60	-0.33	-1.8
Business Cycle Risk	1.37	0.10	1.00	5.8

Aggarwal then makes the following statement:
"Exhibit 1 shows that Portfolio X will benefit from a growing economy and improving confidence because the factor sensitivities for confidence risk and business cycle risk are greater than the factor sensitivities for the benchmark. Portfolio Y is a factor portfolio for inflation risk because of relatively high exposure to inflation risk, and low factor sensitivities for confidence risk and business cycle risk."

Aggarwal wants to know how active management is contributing to portfolio performance.

Jha responds, "Results from our analysis show that Portfolio X has annual tracking error of 6% and an information ratio of 2.1 while Portfolio B has annual tracking error of 0.65% and an information ratio of 0.8."

17. Regarding Jha's explanation of the multifactor models, he is *least likely* correct about:
    A. description of models' factors.
    B. intercept value.
    C. factor sensitivities.

18. Based on the information given in Exhibit 1, the expected return of Portfolio X is *closest* to:
    A. 5.0%.
    B. 15.8%.
    C. 12.3%.

19. Is Aggarwal's statement about portfolios shown in Exhibit 1 *most likely* correct?
    A. Yes.
    B. No, she is incorrect about Portfolio X.
    C. No, she is incorrect about Portfolio Y.

20. Based on Jha's response about portfolio performance, the *most likely* conclusion is, the portfolio that has benefited the most from active management is:
    A. portfolio Y because of tracking error.
    B. portfolio Y because of information ratio.
    C. portfolio X because of information ratio.

The following information relates to questions 21 - 22.

Zara Kramer works as a portfolio manager at RCK Investments. She meets with Bill White, the chief investment officer of a corporate pension fund, to discuss portfolio strategies and techniques used in the management and risk assessment of the fund. White asks Kramer, "I would like to understand the model that you use to choose stocks for the pension portfolio?"

Kramer responds, "At RCK, we typically use a multifactor model in which the factors are price-to-earnings ratio (P/E), financial leverage, and market capitalization."

Kramer adds, "We measure portfolio risk by using a risk model to decompose active risk into the following two components – The first component is an 'active factor risk,' which is systematic risk resulting from the differences in factor exposures between the portfolio and the benchmark. The second component is the active specific risk which is expressed as the individual asset's active weight in the portfolio and the variance of returns unexplained by the factors in the model."

Finally, Kramer explains the active return and performance evaluation measures for the fund.

21. The multifactor model described by Kramer is *most likely* a:
    A. macroeconomic factor model.
    B. fundamental factor model.
    C. statistical factor model.

22. Is Kramer *correct* about the components of active risk?
    A. Yes.
    B. No, she is incorrect about the first component.
    C. No, she is incorrect about the second component.

The following information relates to questions 23 – 26.

Corgan Investments is an investment advisory and portfolio management firm that specializes in equities in energy sector in various global markets. Brenda Fraser, senior portfolio manager, is discussing management of the firm's portfolios with a recently hired analyst Patrick Ricoh. Fraser states, "We use factor models when analyzing regional energy index expected returns." Fraser continues, "Factor models are based on the arbitrage pricing theory (APT), which works under three key assumptions:

Assumption 1: A factor model describes asset returns.
Assumption 2: Investors can construct well-diversified portfolios that eliminate factor risk.

Assumption 3: No arbitrage opportunities are possible among well-diversified portfolios."

Fraser adds: "Upon analysis of our three regional portfolios, I have found that all the three portfolios show sensitivity to price-to-cashflow factor (P/CF) as given in Exhibit 1. Information from Exhibit 1 shows the possibility of an arbitrage opportunity that can be exploited by buying Portfolio III while selling short 40% of Portfolio I and 60% of Portfolio II."

Exhibit 1. Portfolio Sensitivities to P/CF Factor

Portfolio	Expected Return	Factor Sensitivity
I	12.0%	0.9
II	13.3%	0.4
III	15.3%	0.6

Fraser concludes, "For our securities analysis we use a three-factor model, to compare the mean expected return of the regional energy index with an individual security's expected return. The three factors are:

Factor 1: P/CF factor that compares stocks of firms in the highest P/CF quartile with the stocks of firms in the lowest P/CF quartile.

Factor 2: A sector excess return factor that compares local energy sector returns with the entire local equity market (MKT).

Factor 3: A capital investment factor."

23. Is Fraser *correct* in the description of APT?
    A. Yes.
    B. No, she is incorrect with respect to Assumption 2.
    C. No, she is incorrect with respect to Assumption 3.

24. Is Fraser *most likely* correct in identifying existence of arbitrage opportunities among the three portfolios?
    A. Yes.
    B. No, because Portfolio I has the highest factor sensitivity.
    C. No, because Portfolio III has the highest expected return.

25. The three-factor model is *most likely* applied for:
    A. portfolio construction.
    B. return attribution.
    C. risk assessment.

26. The three-factor model described by Kramer is *most likely* a:
    A. macroeconomic factor model.
    B. statistical factor model.
    C. fundamental factor model.

The following information relates to questions 27 – 28.

Shania Peters, portfolio manager at a global investment firm focused on consumer staples' stocks is conducting a workshop for new analysts at the firm. She explains that the firm uses a three-

factor model for portfolio construction by selecting securities after comparing them to their respective sector index in their specific regions. Peters shares the following data given in Exhibits 1 and 2 showing the regional sensitivities to the three-factor used in the model and portfolios' characteristics. She asks the participants to calculate the expected return for the different regions, using 0.6% as the risk-free rate.

Exhibit 1: Factor Model and Portfolio Characteristics

Sector Region	Mean Local Index Return	$\beta^*_{P/S}$	β_{MKT}	$\beta_{Div\ yield}$	Information Ratio	Tracking Error
North America	9.0%	0.4	0.3	2.0	1.47	5.0%
Eurozone	7.5%	1.1	1.1	0.6	1.30	7.0%
China	6.5%	0.8	0.9	0.7	2.56	4.5%

*Note: The three factors used in the model are: price-to-sales, market capitalization, and dividend yield.

Exhibit 2: Factor Values

Region	**P/S**	**MKT**	**Div Yld**
North America	0.110	0.045	0.050
Eurozone	0.030	0.060	0.100
China	0.047	0.075	0.099

27. Based on the information in Exhibits 1 & 2, the expected return for China sector portfolio is *closest* to:
    A. 17.0%.
    B. 18.0%.
    C. 16.3%.

28. Based on Exhibit 2, the portfolio that resembles the risk characteristics of an aggressive equity manager is *most likely*:
    A. North America.
    B. China.
    C. Eurozone.

Set 2 Solutions

1. C is correct. "APT is based in part on the assumption that as assets are added to a portfolio, the portfolio becomes well diversified and asset-specific risk is eliminated." Therefore, adding assets to a diversified portfolio should decrease its specific risk. Section 3. LO.a.

2. B is correct. Portfolio B has a factor sensitivity of 1.0 and an expected return of 16.0%. A 50/50 portfolio combining portfolio A and portfolio C would also have a factor sensitivity of 1.0 ((0.8 + 1.2)/2) but and expected return of 17.0% ((15% + 19%)/2). An arbitrage portfolio can be created by selling short portfolio B and purchasing an equally weighted (50/50) portfolio of A and C, to give a net return of 17-16 = 1.0%. Section 3. LO.b.

3. A is correct. Portfolio A's return equation is: 15% = $RF + 0.8\lambda_1$ and portfolio B's return equation is: 16% = $RF + 1.0\lambda_1$. Using portfolio A's equation, RF = 15% - $0.8\lambda_1$. Substituting this in portfolio B's equation gives:
   16% = 15% - 0.8λ1 + 1.0λ1
   0.2 λ_1 = 0.01
   λ_1 = 0.05. Section 3. LO.c.

4. C is correct. A portfolio with a sensitivity of 1 to factor j and a sensitivity of 0 to all other factors is called a pure factor portfolio for factor j. Section 3. LO.c.

5. A is correct. The expected portfolio return using a four-factor model is $E(R_P) = R_F + \beta_1 RMRF + \beta_2 SMB + \beta_3 HML + \beta_4 WML$. The risk free rate is the same for all portfolios therefore it doesn't affect the relative returns. Portfolio 1's return exclusive of the risk free rate is (5.1% x 0.8 + 1.4 x 1.1% + -0.8% x 0.4 + 0.5% x 1.3) = 5.95% which is higher than Portfolio 2's 5.3% (5.1% x 1.0 + 1.4% x 0.2 – 0.8 x 0.6 + 0.5% x 0.8) and Portfolio 3's 5.01% (5.1% x 0.9 + 1.4% x 0.7 -0.8% x 1.2 + 0.5% x 0.8) (RF rate is the same for all portfolios). Section 3. LO.c.

6. B is correct. In the Carhart model, the excess return on the portfolio is explained as a function of the portfolio's sensitivity to a market index (RMRF), a market capitalization factor (SMB), a book-value-to-price factor (HML), and a momentum factor (WML). Section 3. LO.c.

7. B is correct. In a macroeconomic factor model, the factors used are the surprises in economic data relative to expectations. Section 4.2. LO.d

8. B is correct. Standardized betas are used in fundamental factor models, not statistical factor models. Section 4.3. LO.d.

9. B is correct. Information ratio is measured as the active return divided by the tracking error, which the is standard deviation of active returns. The tracking error of Greg's portfolio is $\sqrt{36\%} = 6\%$. The information ratio is therefore 2%/6% = 0.33. Section 5.2. LO.e.

10. A is correct. Greg is correct about active risk but incorrect about active return. The active return consists of two parts: (1) the sum of each factor return x (portfolio's sensitivity to that factor - benchmark's sensitivity) and (2) the active return resulting from security selection. Greg did not include the effect of security selection. Section 5.1 - 5.2. LO.e.

11. C is correct. Total factor risk is the sum of the risk of each of the factors. For Portfolio 1, the total factor risk is 10% + 20% + 10% + 15% = 55%. Section 5.2. LO.e.

12. A is correct. Diversification reduces a portfolio's active specific risk; therefore, the portfolio with the lowest active specific risk is likely to be the most diversified. Portfolio 2 has the lowest active specific risk of 25%. Therefore, Portfolio 2 is likely to be the most diversified. Section 5.2. LO.e, f.

13. B is correct. The return to a stock can be modeled as $R_i = a_i + b_{i1}F_{INF} + b_{i2}F_{GDP} + \epsilon_i$ where R_i = return to stock *i*, a_i = expected return to stock *i*, b_{i1} = sensitivity of the return to stock *i* to inflation surprises. F_{INF} = surprise in inflation, b_{i2} = sensitivity of the return to stock *i* to GDP growth surprises, F_{GDP} = surprise in GDP growth, ε_i= error term with a zero mean that represents the portion of the return to asset *i* not explained by the factor model.
$R_{ATEL} = 0.15 + (0.1 \times 0.015) + (0.3 \times 0) + 0 = 0.1515.$
$R_{ZSTR} = 0.18 + (0.2 \times 0.015) + (0.0 \times 0) + 0 = 0.183.$
The weighted average return = $0.5 \times 0.1515 + 0.5 \times 0.1830 = 0.16725 = 16.725\%$.
Section 4.2. LO.d.

14. B is correct. Wiley incorrectly states the fundamental factor model. In a fundamental factor model, the factors are attributes of stocks or companies such as the book-value-to-price ratio, market capitalization, the price-to-earnings ratio, and financial leverage. Section 4.1. LO.d.

15. C is correct. The APT model gives us the intercept term which is the expected return of the asset. The number and identity of factors are not specified by the APT model. Section 3. LO.a.

16. A is correct. Wiley correctly states the active factor risk and active specific risk. "Active factor risk measures the factor exposures of the portfolio relative to its benchmark. Active specific risk is the contribution to active risk squared due to each asset's active weight (actual weight in the portfolio minus weight in the benchmark) times its residual risk (the variance of the asset's returns left unexplained by the factors)—that is, it measures the residual risk taken on by the portfolio." Section 5.2. LO.e.

17. B is correct. The intercept is not interpreted as an expected return by both models. Model 1 is a macroeconomic factor model. In this model, the intercept value a_i is the expected return on the stock. Model 2 is a fundamental factor model. In fundamental factor models, the factors are given as *returns* rather than return *surprises* to predicted values so they do not generally have expected values of zero. This changes the meaning of the intercept, which is no longer interpreted as the expected return. A & C are correct statements. Section 4.2.-4.3. LO.d.

18. B is correct. The expected return of Portfolio A is given by the APT equation: $E(Rp) = RF + \lambda 1\beta p,1 + ... + \lambda K\beta p,K$
$E(R_X) = 3\% + (0.90 \times 5\%) + (-0.2 \times -1.8\%) + (1.37 \times 5.8\%) = 15.806\%$. Section 3. LO.c.

19. C is correct. Aggarwal is incorrect about Portfolio Y. "Factor portfolios by definition will have a factor sensitivity of 1 to a particular factor and zero sensitivity for all other factors. For Portfolio Y to be a factor portfolio for the inflation risk factor it must have factor beta of 1 to inflation risk and zero for the other factors." Section 3. LO.a.

20. C is correct. Portfolio X has a higher information ratio. Therefore, it has performed better in line with its chosen benchmark in terms of mean active returns per unit of active risk. Section 5.2. LO.f.

21. B is correct. The multifactor model described by Kramer is a fundamental factor model. In fundamental factor models, the factors are attributes of stocks or companies. Fundamental factors that have been used are market capitalization, the price- to-earnings ratio, book-value-to-price ratio and financial leverage. Section 4.1. LO.d.

22. A is correct. Kramer correctly explains the components of active risk. A portfolio's active risk squared can be decomposed into two components: (1) "active factor risk is the contribution to active risk squared resulting from the portfolio's different-from-benchmark exposures relative to factors specified in the risk model" (or systematic risk), and (2) active specific risk (or asset selection risk) is the contribution to active risk squared measured by the portfolio's active weights of individual assets and the assets' residual risk (also referred to as idiosyncratic risk). Section 5.2. LO.e.

23. B is correct. The correct Assumption 2 of APT is, "There are many assets, so investors can form well-diversified portfolios that eliminate asset specific risk" and not factor risk. Section 3. LO.a.

24. A is correct. Fraser correctly spots the possibility of an arbitrage opportunity. Portfolio III has the same factor sensitivity as a portfolio composed of 40% Portfolio I and 60% Portfolio II. $[(0.4 \times 0.9) + (0.6 \times 0.4)] = 0.6$. Portfolio III has a higher expected return than the combined return of Portfolios I & II = $[(0.4 \times 12.0\%) + (0.6 \times 13.3\%)] = 12.78\%$. Hence Portfolio III is currently undervalued with a higher expected return. Section 3. LO.b.

25. A is correct. Corgan Investments most likely uses the three-factor model for portfolio construction. By comparing the expected return of the security with the expected return of its sector index, a portfolio would be constructed by selecting securities with expected returns higher than the benchmark. The model is not being used for risk or return attribution of a portfolio. Section 5.3. LO.f.

26. C is correct. Corgan's three-factor model is a fundamental factor model because it considers such factors as P/CF, capital investment, and equity returns. There is no reference to

macroeconomic factors (e.g., interest rates, inflation risk, business cycle risk, or credit spreads) and statistical factors (e.g., historical covariances). Section 4.1. LO.d.

27. B is correct. $E(R_P) = (0.8 \times 0.047) + (0.9 \times 0.075) + (0.7 \times 0.099) + 0.006 = 18.04\%$. Section 4.2. LO.c, d.

28. C is correct. The Eurozone portfolio has the highest tracking error. Tracking error is active risk. An aggressive equity manager would be expected to have the highest tracking error. Section 5.2. LO. e, f.