

## Short-Answer

### Assumptions for problems 1 through 15

- 1) The one-year risk-free interest rate in the United States is 3%.
- 2) The market index can be purchased for \$1000 and will generate a cash flow one year from today of \$1500 if the economy is strong or \$700 if the economy is weak. These two outcomes are equally likely.

1. Given the following information about net present values (NPV) which of the following risk-free projects would you recommend your firm accept if it can accept as many as it wants (not limited to only one)? All of the projects require an investment of \$100,000.

<u>Project</u>	<u>NPV</u>
A	+ 500
B	- 1000
C	- 10
D	+ 800

Accept A and D

2. For a given market risk premium, what will cause the risk premium for a particular security to be higher?

Returns on security vary more with market index.

3. You have just discovered an opportunity to invest \$10,000 in a risk-free investment that will pay you \$11,000 a year from today. Set up the calculations that would indicate how much someone would have to pay you to buy the investment opportunity from you? Note: If you sell the opportunity, the buyer would then make the investment instead of you.

$$11,000/1.03 - 10,000$$

4. Security X pays \$1100 if the economy is strong and \$300 if the economy is weak. How could you duplicate the payoff of this security with the market and risk-free bonds? (See general assumptions above).

Buy market and short-sell bond that matures for \$400 in 1 year.

5. What set of arbitrage transactions will allow you to earn an arbitrage profit on the following bonds? Assume that all three bonds have the same risk.

<u>Bond</u>	<u>Price</u>	<u>Cash Flow in One Year</u>
A	\$1000	\$1100
B	\$2000	\$2200
C	\$2900	\$3300

Buy C, short sell A and B

6. What would you compare if someone offered to trade you shares of Google for an equal number of shares of eBay?

Market prices.

7. Other things being equal, what is the attitude of investors towards risk?

Prefer less.

Problems from Chapter 3

8. Set up the calculations required to determine the net present value of a risk-free investment that will cost \$20,000 today and that will pay \$25,000 one year from today.

$$25,000/1.03 - 20,000$$

9. An ETF includes one share of A and one share of B. The market price of the ETF is \$50, of A is \$20, and of B is \$25. Set up the calculations that show the arbitrage profit you can earn per share of the ETF.

$$50 - 20 - 25$$

10. Is arbitrage possible given the following prices for two risk-free bonds that will pay \$1000 a year from today? Note: you do not need to show any work.

	<u>Bid</u>	<u>Ask</u>
Bond #1	970.72	970.87
Bond #2	970.85	971.05

No.

11. What must be true about the value of any asset that trades in a competitive market?

Equals market price

12. In a normal market, what is the net present value of buying or selling securities?

0

13. Assume you expect Ford stock to fall from its current \$6 per share to \$2 per share six months from today. As a result, you short sell 100 shares of Ford today. Set up the calculations to determine the cash flow that occurs today? Note: use a "+" for an inflow and a "-" for an outflow.

$$+6 \times 100$$

14. Security X pays \$1600 if the economy is strong and \$800 if the economy is weak. How could you duplicate the payoff of this security with the market and risk-free bonds? (See general assumptions above)

Buy market and bond that matures for \$100 in 1 year.

15. What set of arbitrage transactions will allow you to earn an arbitrage profit on the following bonds? Assume that all three bonds have the same risk.

<u>Bond</u>	<u>Price</u>	<u>Cash Flow in One Year</u>
A	\$1000	\$1100
B	\$2000	\$2200
C	\$3100	\$3300

Short sell C, buy A and B

Problems from Chapter 3

Use the following data to answer question 16

<u>Date</u>	<u>Days</u>	<u>Dividend</u>	<u>Price</u>
8/31	0	\$0.00	\$57.35
11/13	74	\$0.43	\$52.64
2/13	166	\$0.47	\$50.34
5/13	256	\$0.47	\$47.55
8/13	348	\$0.47	\$48.38
8/29	364	\$0.00	\$46.65

16. Assume that on 8/31 you short-sold 500 shares of the stock and that on 8/29 you closed out your short position. Calculate your profit or loss from selling short.

$$500(57.35 - .43 - .47 \times 3 - 46.65)$$

17. Assume you have the opportunity to buy an office building for \$1.5 million that you can sell for \$1.8 million. What else do you need to know before you can make a decision on whether to buy the building?

1) when cash flows occur, 2) uncertainty of cash flows, 3) level of interest rates  
or: 1) when cash flows occur, 2) cost of capital for building

18. In order for there to be no arbitrage opportunities, what relationship must always exist between bid prices and ask prices for Dell stock in the markets on which Dell stock trades?

Lowest ask > highest bid

19. What is the law of one price?

Equivalent investments trading at the same time in different normal markets must have the same price

20. Your firm has an opportunity to invest \$5 million today in a project that will generate a risk-free payoff of \$6 million a year from today. List the actions your firm would have to take today and next year to turn the project's NPV into cash today.

Today: borrow PV of \$6 million; Next year: pay off loan with proceeds of project

21. What must you do to close out a short position in Dell stock?

Buy Dell stock, give back to whoever borrowed it from.

22. Assume that the risk-free rate is 3%. Assume also that the market index has a current price of \$660 and is equally likely to provide a pay off of \$500 or \$900 a year from today. Calculate the no-arbitrage price of JZX Corporation stock if it is equally likely to provide a payoff of \$600 or \$1000?

$$660 + \frac{100}{1.03}$$

23. List (but do not discuss) the two changes that will lead to an increase in the market risk premium.

Increase in investor risk aversion, increase in risk of the market

Problems from Chapter 3

24. What is an example of a transaction cost you would pay to trade securities?

Broker commission or bid-ask spread

## Problems

1. Assume that a risk-free bond that pays \$200 a year from today has a market price today of \$190. Assume also that the market price today of the market index is \$1000 and that a year from today the market index pays either \$1500 (in a strong economy) or \$600 (in a weak economy). Finally, assume that stock of eBait (where people can buy and sell new and used bait) will pay off either \$1300 (strong economy) or \$400 (weak economy) a year from today. What transactions would create an arbitrage profit and what would your profit be if the market price today of eBait's stock is \$850? Note: you will need to do some arithmetic calculations to answer this one.

Duplicating eBait: buy market and short-sell risk-free bond.

Strong: Payoff on duplicating =  $1500 - 200 = 1300 =$  Payoff on eBait

Weak: Payoff on duplicating =  $600 - 200 = 400 =$  Payoff on eBait

Cost: duplicating portfolio =  $1000 - 190 = 810 < 850 =$  eBait.

Arbitrage: buy duplicating portfolio (duplicates eBait) and short-sell eBait

=> buy market, short-sell eBait and short-sell risk-free bond

Arbitrage profit =  $-\$1000 + 850 + 190$

Alternative solution:

Duplicating market: buy eBait and risk-free bond

Strong: Payoff on duplicating =  $1300 + 200 = 1500 =$  Payoff on market

Weak: Payoff on duplicating =  $400 + 200 = 600 =$  Payoff on market

Cost: duplicating portfolio =  $190 + 850 = 1040 > 1000 =$  market

Arbitrage: short-sell duplicating portfolio (duplicates market) and buy market

=> buy market, short-sell eBait and short-sell risk-free bond

Arbitrage profit =  $-\$1000 + 850 + 190$

2. Assume that each of the following securities is risk-free. Bond A has a market price today of \$950 and pays \$1000 in one year. Bond B has a market price today of \$900 and pays \$1000 in two years. Bond C pays \$1000 in one year and \$2000 in two years. What transactions would create an arbitrage profit and what would your profit be if Bond C's market price today is \$2700? Note: you will need to do some arithmetic calculations to answer this one.

Duplicating C: buy an A and 2 Bs

t=1: Payoff on duplicating =  $\$1000 =$  Payoff on C

t=2: Payoff on duplicating =  $\$1000 \times 2 = \$2000 =$  Payoff on C

Cost: duplicate portfolio =  $950 + 900(2) = 2750 > 2700 =$  C

Arbitrage: Buy C and short-sell duplicating portfolio

=> buy C, short-sell A, short-sell 2 Bs

Arbitrage profit =  $-\$2700 + 950 + 2(900)$

Problems from Chapter 3

3. Assume that American Airways' stock has a market price of \$70 and will generate cash flow per share a year from today of \$100 if the economy is strong or \$60 if the economy is weak. Assume also that Northeast Airlines' stock has a market price of \$45 and will generate cash flow per share a year from today of \$80 if the economy is strong or \$40 if the economy is weak. Finally, assume that risk-free bonds that pay \$1 a year from today have a market price of \$0.95.

a. Given this information, what set of transactions today will generate an arbitrage profit? What is your profit today from this transaction?

b. Show that the conditions of arbitrage are met in both a strong and weak economy.

a. Can duplicate AA with NA and bonds that mature for \$20. Cost of duplicating portfolio =  $45 + 20(.95) = 64$   
 $\Rightarrow$  arbitrage = buy NA, buy bonds that mature for \$20 and short-sell AA  
 $\Rightarrow$  profit =  $-45 - 20(.95) + 70 = 6$

b. Strong: payoff =  $0 = 80 + 20 - 100$ ;  
 Weak =  $0 = 40 + 20 - 60$

4. Assume that a year from today there is a 60% chance of a weak economy and a 40% chance of a strong economy. Assume also that two years from today there is a 30% chance of a weak economy and a 70% chance of a strong economy. Finally, assume that you can buy or sell the following securities at the market values listed below.

**Note:** In order to answer parts b and c, you will need to do some calculations. If you cannot do them in your head, feel free to use a calculator.

Security	Market Value	Payoff one year from today if the economy is:		Payoff two years from today if the economy is:	
		Weak	Strong	Weak	Strong
A	92	90	110	0	0
B	92	0	0	90	110
C	1100	90	110	900	1100

a. Calculate the expected return on security A.

b. What set of transactions involving securities A, B, and C will allow you to earn an arbitrage profit?

c. Calculate the arbitrage profit you will earn in b above.

a.  $E(R) = .6\left(\frac{90-92}{92}\right) + .4\left(\frac{110-92}{92}\right)$

b.  $C = A + 10B = 92 + 10(92) = 1012$   
 $\Rightarrow$  short-sell C, buy A and buy 10 B

c.  $1100 - 1012 = 88$

5. Assume that you can buy or sell the following securities at the market prices listed below.

<u>Security</u>	<u>Market Price</u>	Payoff one year from today if the economy is:		Payoff two years from today if the economy is:	
		<u>Strong</u>	<u>Weak</u>	<u>Strong</u>	<u>Weak</u>
S	100	125	90	0	0
L	110	0	0	150	100
ETF	510	250	180	450	300

**Note:** In order to answer this question, you will need to do some actual calculations.

- Assume that the ETF has invested in some number of shares of S and L. Calculate the no arbitrage price for the ETF.
- Given the market prices, list the transactions that would allow you to earn an arbitrage profit.
- Show that the conditions of arbitrage are met today, a year from today, and two years from today.

a.  $P = 2(100) + 3(110) = 530$

b. Buy ETF, short-sell two S, short-sell three L

c.  $t = 0: -510 + 2(100) + 3(110) = +20$

$t = 1: W: +180 - 2(90) = 0; S: +250 - 2(125) = 0$

$t = 2: W: +300 - 3(100) = 0; S: +450 - 3(150) = 0$

6. Assume that you can buy or sell the following securities at the market prices listed below.

<u>Security</u>	<u>Market Price</u>	Payoff one year from today if the economy is:		Payoff two years from today if the economy is:	
		<u>Strong</u>	<u>Weak</u>	<u>Strong</u>	<u>Weak</u>
A	60	100	60	0	0
B	90	0	0	120	100
ETF	1300	500	300	1200	1000

**Note:** In order to answer this question, you will need to do some actual calculations. If you cannot do them in your head, feel free to use a calculator.

- Assume that the ETF has invested in securities A and B. Calculate the no arbitrage price for the ETF.
- Given the market prices, list the transactions that would allow you to earn an arbitrage profit.
- Show that the conditions of arbitrage are met today, a year from today, and two years from today.

a.  $P = 5(60) + 10(90) = 1200$

b. short-sell ETF, buy five A, buy ten B

c.  $t = 0: +1300 - 5(60) - 10(90) = +100$

$t = 1: S: -500 + 5(100) = 0; W: -300 + 5(60) = 0$

$t = 2: S: -1200 + 120(10) = 0; W: -1000 + 100(10) = 0$

Problems from Chapter 3

7. Assume that securities A through D provide risk-free payoffs as follows:

<u>Security</u>	<u>Price today</u>	<u>Cash Flow in:</u>		
		<u>One Year</u>	<u>Two Years</u>	<u>Three Years</u>
A	95.552	100	0	0
B	91.754	0	100	0
C	87.959	0	0	100
D	525.000	200	200	200

- What trades would allow you to take advantage of this arbitrage opportunity? Note: the trades should create an arbitrage profit for you.
- What cash flows will your trades in part "a" generate today and at the end of each of the next 3 years?

Equivalent portfolio = 2A + 2B + 2C

No arbitrage price =  $2(95.552) + 2(91.754) + 2(87.959) = 550.53$

- Buy D, short-sell two A, two B, and two C
- $CF_0 = -525 + 550.53 = 25.53$   
 $CF_{1-3} = 0$



## Multiple-Choice

Use the following information to answer questions 1 and 2: Next year, there is an equal chance that the economy will be strong and that the economy will be weak. A \$100 investment in the market will pay \$130 if the economy is strong and \$90 if the economy is weak. One hundred shares of Universal Food's stock will be worth \$190 if the economy is strong and \$150 if the economy is weak. The risk-free interest rate is 7%.

- Calculate the no-arbitrage price of 100 shares of Universal Food stock.
  - \$160.00
  - \$43.93
  - \$107.00
  - D. \$156.07**
  - \$100.00
- Calculate the expected return on Universal Food if its price currently equals \$150.
  - 0.0%
  - B. + 13.3%**
  - 21.1%
  - + 26.7%
  - 7.0%
- Which of the following statements related to risk is incorrect?
  - A. the market risk premium will increase if investors become less risk averse**
  - the market risk premium will increase if the risk of the market rises
  - investors prefer less risk other things equal
  - a security's risk premium will be higher the more its return tends to vary with the market
  - the market risk premium balances the supply and demand for risk
- Based on the following information calculate the arbitrage profit you would generate from setting up trades with the following securities and indicate whether this arbitrage involves buying or short selling one share of the ETF as a part of the arbitrage.

Security	Price	Cash Flow at	
		<u>t = 1</u>	<u>t = 2</u>
A	95	100	0
B	89	0	100
ETF	610	200	500

- \$25, short-sell the ETF
  - B. \$25, buy the ETF**
  - \$30, short-sell the ETF
  - \$50, short-sell the ETF
  - \$30, buy the ETF
- Assume that the risk-free rate is 3% and that a risk-free bond pays \$1000 a year from today. Calculate your arbitrage profit today if the bond's price is \$960.
    - no arbitrage is possible
    - +\$11.20
    - +\$40.00
    - +\$38.83
    - E. +\$10.87**

Problems from Chapter 3

6. Assume you short-sell 100 shares of Ford at the price of \$10 per share. By the time you close out your position, Ford's stock price has risen to \$12 per share and Ford has paid a dividend of \$0.10 per share. Calculate your profit or loss on the short position.
- a. gain of \$990
  - B. loss of \$210**
  - c. loss of \$200
  - d. loss of \$1000
  - e. gain of \$190
7. Assume that each share of an ETF with a current market price of \$215 per share consists of 5 shares of General Electric (GE), 2 shares of Citigroup (C), and 3 shares of Best Buy (BBY). Assume that the current market price of GE is \$16 per share, that the current price of C is \$5 per share, and that the current market price of BBY is \$39 per share. Which of the following will generate a positive arbitrage profit for you?
- a. buy 1 share of the ETF, and short sell 1 share of GE, C, and BBY
  - B. short sell 100 shares of the ETF, buy 500 shares of GE, buy 200 shares of C, and buy 300 shares of BBY**
  - c. buy 100 shares of the ETF, short sell 500 shares of GE, short sell 200 shares of C, and short sell 300 shares of BBY
  - d. short sell 1 share of the ETF, and buy 1 share of GE, C, and BBY
  - e. none of the above will create an arbitrage profit
8. Which of the following is the definition of a bid price?
- a. the lowest price at which anyone is willing to sell
  - b. the highest price at which anyone is willing to sell
  - C. the highest price at which anyone is willing to buy**
  - d. the lowest price at which anyone is willing to buy
  - e. the definition depends on whether you are planning to buy or planning to sell