9 Hull, Chapter 11: Trading Strategies Involving Options

Learning Outcomes:

Explain the motivation to initiate a covered call or a protective put strategy.

Describe and explain the use and payoff functions of spread strategies, including bull spread, bear spread, calendar spread, butterfly spread, and diagonal spread.

Calculate the pay-offs of various spread strategies.

Describe and explain the use and payoff functions of combination strategies, including straddles, strangles, strips, or straps.

Compute the pay-offs of combination strategies.

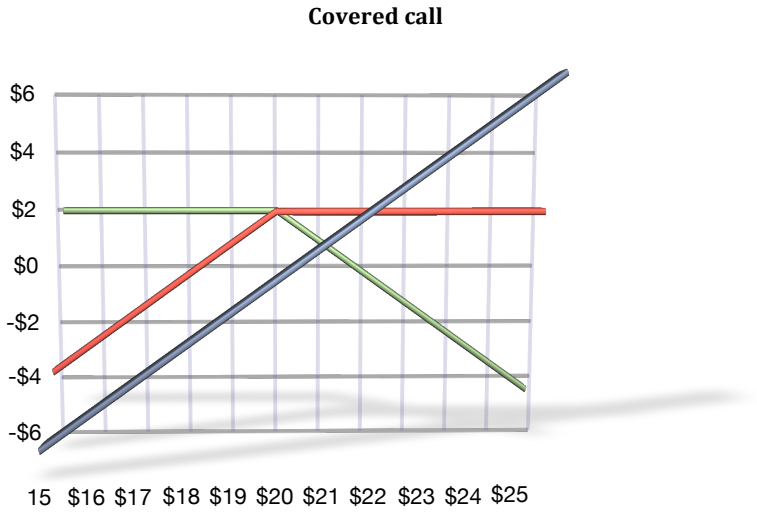
9.1 Explain the motivation to initiate a covered call or a protective put strategy and calculate the payoff functions of the respective strategies.

9.1.1 Covered Call

To "write a covered call" is to combine a long stock position with a short position in a call option. Writing a covered call = long stock + short call option. In many cases, the call option is out-of-the-money. The rationale of the covered call is either:

1. To generate income via the sale of the short call, or
2. To cover the cost of the potential short call payoff with the stock.

Covered call; Long stock @ $20 + Short call Strike @ $20 (premium = $1.99)
Writing a covered call is an income strategy.
Outlook is neutral to bullish.



Payoff: Red, **Option:** Green, **Stock:** Blue
Covered call: Long stock @ $20 + Short call ($K_{Short\ call} = \$\mathbf{20}$, premium = $1.99)

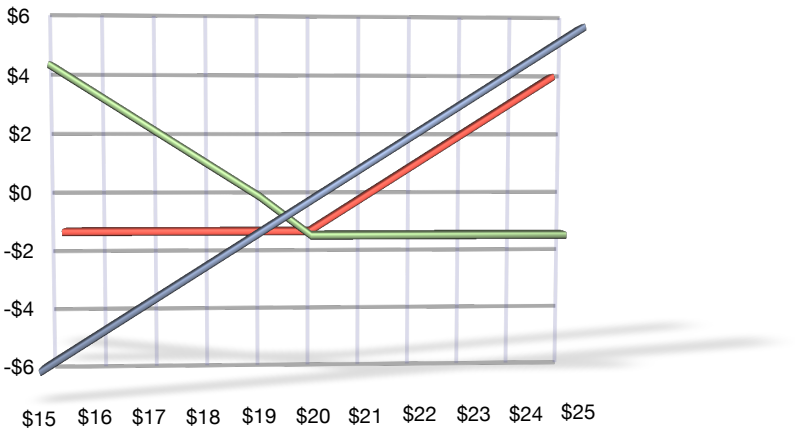
Writing a covered call is an income strategy, that is, we will enter into this trade if our outlook is neutral to bullish. That is, if the stock rises significantly, the call option will be exercised; however, we have the underlying to protect ourselves from that scenario. On the other hand, by writing a call option we collect the premium. Thus if the stock price stays about the same or rises modestly, we collect the premium. We can then use this strategy by rolling over the options each month, collecting our premium. At first look we might view this as an easy way to generate a healthy income each month. However, chances are that we are not the only ones who have thought of this; hence, it will be priced into the option. Accordingly, over time, when we take into account the transaction costs we incur, as well as the fact that from time to time the option will get exercised, this is a poor income generating strategy.

IMPORTANT CONCEPT:

If the payoff strategy looks like a short put option, that's because it is! Remember the put-call parity $S_0 - c = Ke^{-rt} - p$. We can infer from this that going long the stock and short a call is the same as going short a put with the PV of the strike price in the bank. By knowing the intuition behind the put-call parity you can often reason your way to the answer!

9.1.2 Protective Put

A protective put can be thought of as a form of insurance. Indeed, looking at the strategy and the payoff, it looks like we have created a synthetic call option! Again, the put-call parity comes in handy. It is tempting to think that having protective puts on your portfolio and rolling them over at maturity is a great way to benefit from the potential increase in the stock price while having our losses capped. However, the premium paid and transaction costs incurred dilute the profits form such a strategy, just like in the case of the Covered call. We can generalize this concept further by noting that, after adjusting for risk, there is no one strategy that offers an easy way to make money in a [weak form] efficient market. There is no such thing as a free lunch.



Payoff: Red; Option: Green; Stock: Blue
Protective put: Long stock @ \$20 + Long put ($K_{long\ put}$ = \$20, premium = \$1.20)

Important Concept:

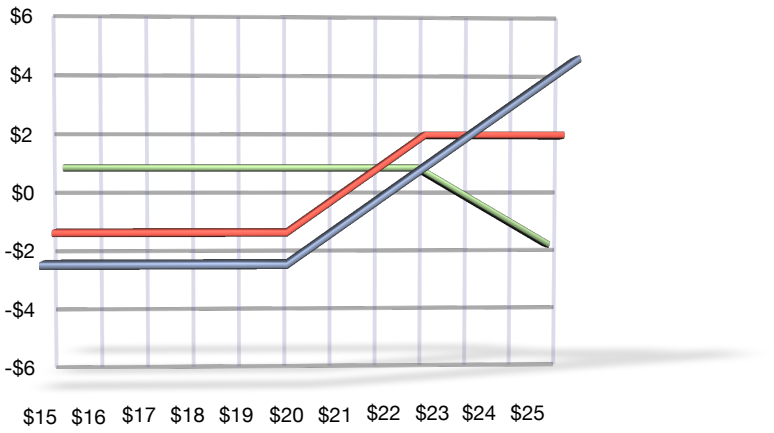
The covered call generates income (the short call option premium) when the (long) stockholder does not expect further price appreciation on the long position. The protective put forfeits some income (the long put option premium) in exchange for downside protection.

9.2 Describe and explain the use and payoff functions of spread strategies, including bull spread, bear spread, calendar spread, butterfly spread, and diagonal spread.

A spread strategy is a position with two or more options of the same type, i.e., two or more calls; or, two or more puts.

9.2.1 Bull spread (type of vertical spread)

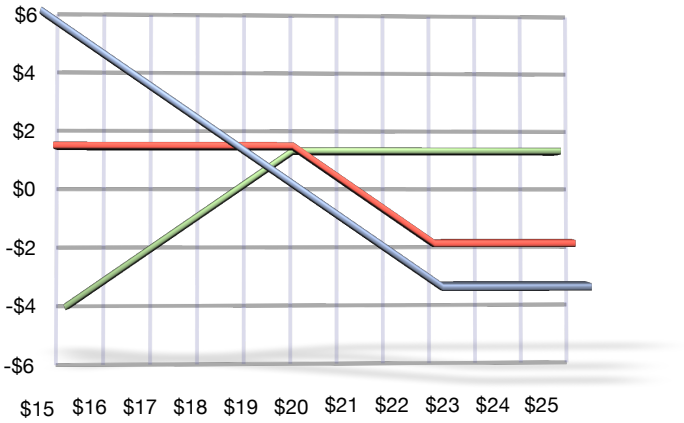
A bull spread can be created by writing a call with, e.g. strike $K_{short} = \$23$, while going long a call with a lower strike price, $K_{long} = \$20$, on the same stock (with the same expiration). In this example, we go long a call @ strike = \$20, with a premium = \$1.99 + short call @ strike = \$23, with a premium = \$0.83. When creating a bull spread using call options there is always a cash outflow; conversely, when creating a bull spread using put options there is always a cash inflow. In both cases we are bullish, as the name implies, and thus expect the price of the underlying to increase.



Payoff: Red; **put option:** Green; **call option:** Blue
Protective put: Long call ($K_{long\ call} = \$20$, premium = \$1.99) + short call ($K_{short\ call} = \$23$, premium = \$0.83)

9.2.2 Bear spread (type of vertical spread)

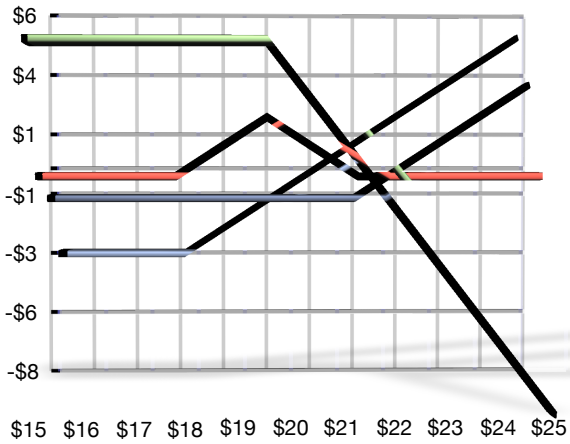
A bear spread can be created by writing a put option with, e.g., strike $K_{short} = \$20$, while going long a put with a higher strike price $K_{long} = \$23$, on the same stock (with the same expiration). It is important to note that we can create a bear spread either using put options or call options (think about the payoff profile in terms of the put-call parity). When creating a bear spread using put options there is always a cash outflow, whereas when creating a bear spread with calls we have a cash inflow. In this latter case we would simply buy a call and sell a call but our strike price on the long call is higher than on the short call: $K_{long\ call} > K_{short\ call}$. In both cases we are bearish as the name implies and thus expect the underlying stock price to decline. As the graph below show, we have a range of possible payoff scenarios, however; our loss is capped at \$0 (excluding the premium), while our gain is capped at $K_2 - K_1$ (excluding the premium).



Payoff: Red; **Option:** Green; **Stock:** Blue
Long put $\boldsymbol{K_{long\ put}} = \$\mathbf{23}$, premium = -\$2.93) + short put $\boldsymbol{K_{short\ put}} = \$\mathbf{20}$, premium = \$1.20)

9.2.3 Butterfly spread (sideway strategy)

Buy a call option at low strike price K1, buy a call option with high strike price K3, and sell two call options at strike price K2 halfway between K1 and K2. In this example, the butterfly spread: Long call ($K_{long\ call}$ = \$18, premium = \$3.21), long call ($K_{long\ call}$ = \$22, premium = \$1.13) short two calls (strike @ \$20, premium = \$1.99). **Why the butterfly?** The investor expects low volatility (range-bound), and wants to cap her risk.



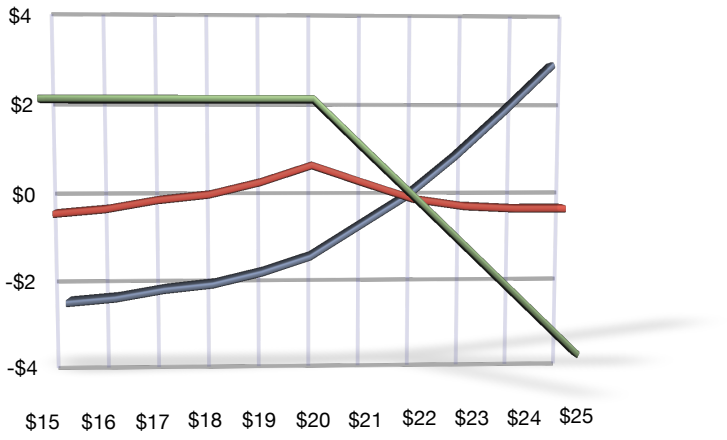
Payoff: Red; **put option:** Green; **call options 2 & 3:** Blue

9.2.4 Calendar spread

In a calendar spread, the options have the same strike price but different expiration dates. The calendar spread can be created with calls or puts.

- Two calls: sell a call option with strike price K1 and buy a call option with same strike price K1 but with a longer maturity term.
- Two puts: sell a put option with strike price K1 and buy a put option with same strike price K1 but with a longer maturity term.

Calendar Spread



Payoff: Red; Option: Green; Stock: Blue
Short call with 1y maturity ($K_{short\ call} = \$20$, premium = \$1.99) + Long call with 1.25y maturity ($K_{long\ call} = \$20$, premium = \$2.27)

9.2.5 Diagonal spread

In a diagonal spread, both the expiration date and the strike price of the calls are different.

9.2.6 Box spread

A box spread is a combination of a bull call spread with strike prices K1 and K2 and a bear put spread with the same two strike prices. The payoff from a box spread is always K2 – K1. The value of the box spread is always the present value of its payoff or $(K_2 - K_1)e^{-rT}$.

IMPORTANT CONCEPT:

"A box spread arbitrage only works with European options" (Hull)

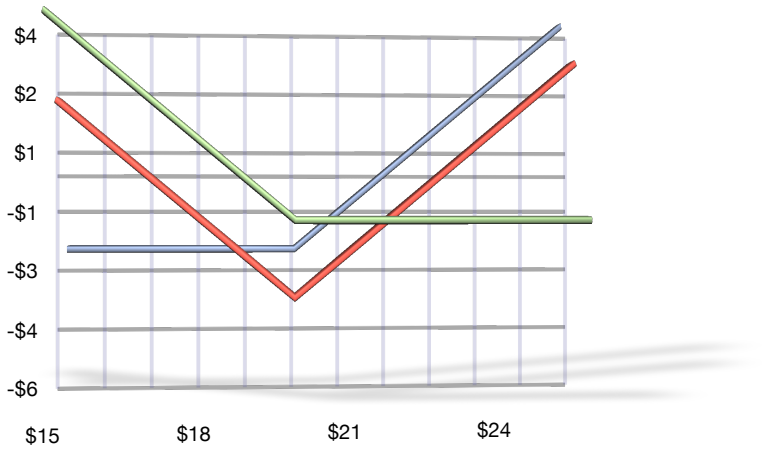
9.3 Describe and explain the use and payoff functions of combination strategies, including straddles, strangles, strips, or straps

A combination strategy involves taking a position in both call(s) and put(s) on the same stock

9.3.1 Straddle

To straddle is to buy a call and buy a put on the same stock with same strike price and expiration date. **Why the (bottom) straddle?** The investor expects a large move in either direction. The worst-case scenario is that the stock settles at the strike price: the investor has paid two premiums but does not receive any payoffs. This illustrated straddle consists of a long call (strike @ $20, premium = $1.99) plus a long put (strike $20, premium = $1.20). This straddle is a "bottom straddle."

Straddle



Payoff: Red; **put option:** Green; **call option:** Blue
Long call ($K_{long\ call} = \$20$, premium = $1.99) plus a long put ($K_{long\ put} = \$20$, premium = $1.20)

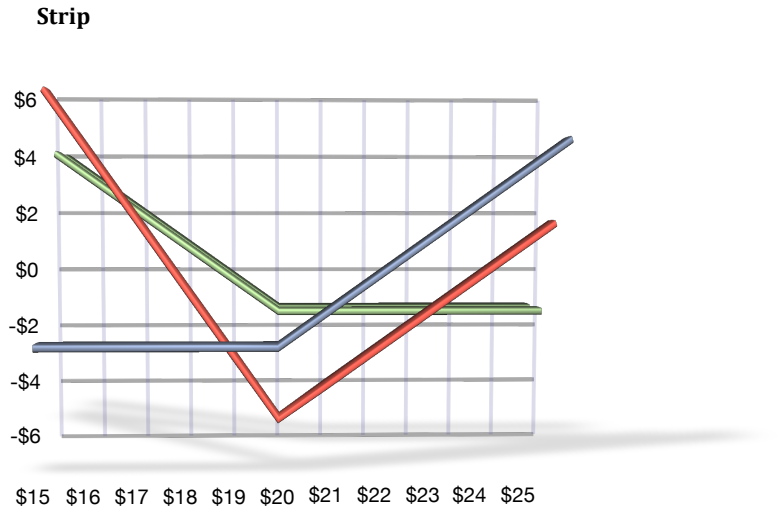
IMPORTANT CONCEPT:

A straddle is a **direction neutral volatility strategy**: we don't mind which way the underlying moves. As an example, a **bottom straddle** involves buying both a call and a put with the same strike price and expiration date. In this case, as long as the price moves sufficiently, we are invariant to which way it moves. Conversely, for **a top straddle**, we want the price to deviate from the strike as little as possible.

A top straddle (or straddle write) is to sell a call and sell a put on the same stock with same strike price and expiration date. **Why the top straddle?** The investor is highly confident that the stock will not stray from the strike price in either direction. If the stock price equals the strike price, the investor has collected two premiums for profit. This is a very risky strategy however, because the potential loss is unlimited. As you can see, a top straddle is also a direction neutral volatility strategy; however, unlike with the bottom straddle, we want little to no movement in the underlying.

9.3.1 Strip

Strip: To take a long position in one call and two puts with same strike price and expiration date. **Why the strip?** The investor bets on a large stock price move but considers a decrease more likely than an increase. This illustrated strip consists of a long call (strike @ $20, premium = $1.99) plus two long puts (strike @ $20, premium = $1.20).

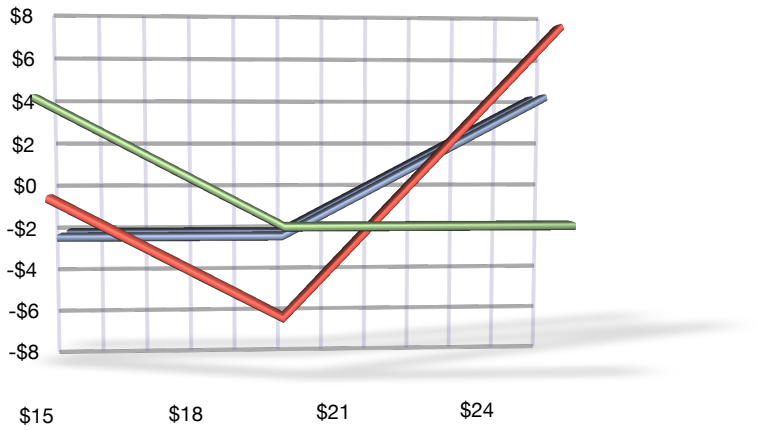


Payoff: Red; **put option:** Green**; call option:** Blue
Long call ($K_{long\ call} = \$20$, premium = $1.99) plus two long puts $K_{long\ put} = \$20$, premium = $1.20)

9.3.2 Strap

Strap: To take a long position in two calls and one put with same strike price and expiration date. Why the strap? Like the strip, the investor bets on a large stock price movement, but instead considers an increase more likely. In this regard a strap is also similar to a straddle, but in this case we are biased upwards. This illustrated strap consists of two long calls (strike @ $20, premium = $1.99) plus a long put (strike @ $20, premium = $1.20).

Strap

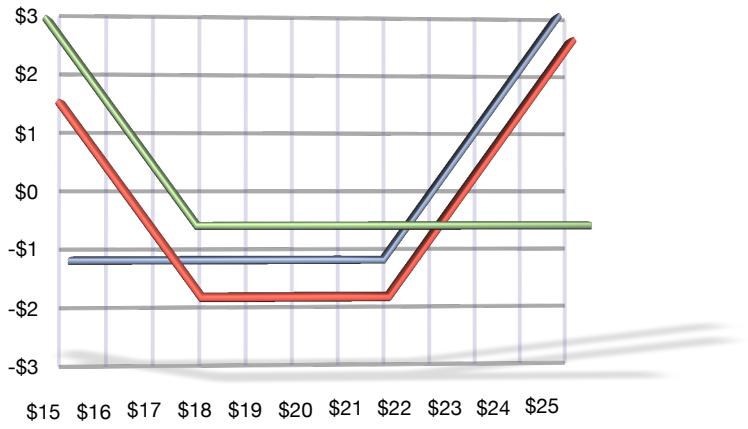


Payoff: Red; **put option:** Green**; call option:** Blue
Two long calls ($K_{long\ call}$ = $20, premium = $1.99) plus a long put ($K_{long\ put}$ = $20, premium = $1.20)

9.3.3 Strangle

Strangle: To buy a put and a call with the same expiration and different strike prices. **Why the strangle?** The investor is betting on a large price movement (similar to the straddle). This illustrated strangle is a long call (strike @ $22, premium = $1.13) plus a long put (strike $18 premium = $0.51). A strangle is similar to a straddle but cheaper to install, however; this comes at the cost of requiring more extreme price movements than with the straddle. Consequently, this is a strategy that is bullish on volatility.

Strangle



Payoff: Red; **put option:** Green**; call option:** Blue

9.3.4 Collar and costless collar

A collar (sometimes also referred to as a fence) is a combination strategy where we own the underlying, sell a call option with a strike price greater than the current price of the underlying ($K_{call} > S$), and buy a put option with a strike price less than the current price of the underlying ($K_{put} < S$). This strategy gives us a range of profit or losses. When the premium collected from writing the call exactly matches the premium paid for the put, we have what is called a zero cost, or *costless collar*.

9.4 Compute the pay-offs of combination strategies.

Please see the practice question (PDF) set.

9.5 Summary of Options Strategies

The options strategies we have seen are but a few of the many that are used on a daily basis. However, they form the basis of many such strategies. That is, a combination of the strategies we have reviewed can be used to construct any options strategy - your imagination (and wallet) is the limit. It is important to note that, while several of the strategies seem to lock in a guaranteed profit, or have a seemingly high probability of making money, this is largely an illusion due to the transaction costs involved - and the spread between the bid and the ask price actually observed in the market. We can generalize this further: typically, only when your expectations differ from that of the market will there be a genuine moneymaking opportunity. However, going against the market can pose a significant risk as options enable you to leverage your positions in a way that regular stocks and bonds do not. That being said, there are many scenarios in which putting on any of the aforementioned options strategies would makes sense. The primary reason why we would want to do this is to hedge our risk, and the secondary reason is that we simply hold a different view than the market and are making an informed bet. Investment banks are typically more than willing to act as market makers as, on average, they end up with a net profit due to this sort of market making.

After reading this chapter (and completing the accompanying exercises in the separate PDF) you should be able to define and calculate the payoff of a:

- Principal-protected note
- Covered call
- Protective put
- Bull spread
- Bear spread
- Butterfly spread
- Calendar spread
- Diagonal spread
- Box spread
- Straddle
- Strap
- Strip
- Strangle
- Collar

You should also be able to specify under what circumstances each of these strategies would be appropriate to put on, and you should know which strategies are direction neutral with respect to a risk factor, and which ones are not.

9.6 Concept check - questions & answers

9.6.1 Questions

1. What are some of the benefits of "options strategies" over a single call or put option investment?

2. You believe volatility is about to drop. What is the appropriate strategy?

3. Of the following options strategies, which one is the most risky?
    a. Buying a bull spread
    b. Buying a bear spread
    c. Writing (selling) naked put options
    d. Writing (selling) naked call options

4. An asset manager tells you he wants to go long a straddle because he has a bullish view on volatility (and the movement of the stock price). The asset manager tells you that this strategy is always superior to a strangle, since you need less of a price movement in order to be net In-the-Money. Is the asset manager right? Why or why not?

5. An investor wants to hedge her bond portfolio. Being sensitive to interest rate the investor decides to sell a call option with $K_{call} \geq S$ to finance entirely the cost of going long a put option where $K_{put} \leq S$ which hedges against an increase in interest rate (remember the value of a portfolio of bonds decreases when the payments are discounted more heavily). Which option strategy is the investor employing?
    a. Butterfly
    b. Costless collar
    c. Strangle
    d. Box spread

6. You are bearish on the market (you think the market will go down) so you decide to use the following options, all with the same maturity: buy a put with $K_{put} =$ \$49 for \$8, sell two puts with $K_{put} =$ \$40 for \$5 each, and buying one put where $K_{put} =$ \$49 for \$3. If at maturity the underlying trades at S = \$34, what is the profit of your trade?
    a. \$3
    b. \$4
    c. \$5
    d. \$6

7. Why does a box-spread arbitrage only work with European options?

9.6.2 Answers

1. One of the primary goals of the various options strategies is to hedge against exposure from different risk factors. The different options strategies also enable investors to take a view on risk factors other than those associated with just the underlying stock. Indeed, we have seen that there are a number of ways to take advantage of a view on e.g., volatility.

2. When volatility is about to drop, you want to enter into a direction neutral volatility strategy, hoping that the underlying will barely move. In this case the appropriate strategy is a top straddle.

3. Both a, b and c have bounded losses, whereas the potential loss from d is unbounded (limitless). Thus, writing naked call options is the most risky strategy.

4. The asset manager is wrong. While it is true that the straddle requires less of an uptick in volatility (and movement in the stock price in either direction) to make money than with a strangle, this comes at the cost of higher risk downside risk if the stock is OTM at expiration.

5. The investor is employing a costless-collar. Notice that in a costless collar, the premium from selling the call option exactly matches the cost of the put option. The investor accordingly locks in a range of profit and losses since the investor is already long the underlying, buys a [protective] put and sells a call.

6. The profit from the trade is $4, thus (c) is correct. We can calculate this as follows:$S_{maturity} < K$, meaning that at maturity the underlying is worthless than the strike of all the options. Accordingly, all the put options will get exercised. [($49 - $34) - 2 x ($40 - $34) + ($36 - $34)] = $5. The initial option premiums sum up to: (-$8 +2x5 -3) = -$1. Thus $5 - $1 = $4.

7. A box spread arbitrage only works with European options as the payoff is always K2 - K1, while the present value of a European option is thus $(K_2 - K_1)e^{-rT}$.