Queens College, CUNY, Department of Computer Science

Computational Finance

CSCI 365 / 765

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5 Homework: Options 1

- In most textbooks, the most common point of view is that the investor (= you) holds the option. Therefore you (= holder) decide whether to exercise the option or not.
- However, it is different when you are the **writer (= seller)** of an option. The arbitrage strategies for the call options require you to take a **short position** in the call option.
- ***You must be taught what happens and what to do, if you sell an option and it is exercised against you.***
- These homework exercises will give you practice on the subject.
- The perspective of the option writer is unfamiliar and not obvious.
  1. Recall that an option writer has **obligations** but **no rights** (see Lecture 6).
  2. This is an important fact and you must be taught the consequences.
  3. An option is exercised when it is in the money, *i.e. the option holder makes a profit.*
  4. This means the option writer will **suffer a loss** when the option is exercised.
- For a **call option** (both American and European), if the option is exercised, the option writer must **deliver the stock and accept cash** $= K$ **(= strike),** *even though the stock price is* $S \geq K$ *and the option writer will suffer a loss.*
- For a **put option** (both American and European), if the option is exercised, the option writer must **pay cash** $= K$ **(= strike) and receive the stock,** *even though the stock price is* $S \leq K$ *and the option writer will suffer a loss.*
- There are also **cash settled** options.
- Not all options involve delivery of stock. Options on stock indices are settled in cash. The option "strike" is measured in index points. To calculate the cash payment, there is a dollar multiplier M for every index point that the option is in the money.
- For a **cash settled call option** (both American and European), if the option is exercised, the option writer pays the holder cash of $M(S-K)$.
- For a **cash settled put option** (both American and European), if the option is exercised, the option writer pays the holder cash of $M(K-S)$.

5.1 Exercise of long & short call option positions

5.1.1 Long American call option

1. You are **long an American call option**.
2. The call option has a strike of 101.
3. The market price of the stock is 107 today.
4. **You exercise the option. State what you pay/receive.**
5. **State what the option writer pays/receives.**

5.1.2 Long European call option

1. You are **long a European call option**.
2. The call option has a strike of 102.
3. The market price of the stock is 106 today (= expiration day).
4. **You exercise the option. State what you pay/receive.**
5. **State what the option writer pays/receives.**

5.1.3 Short American call option 1

1. You are **short an American call option**.
2. The call option has a strike of 99.
3. The market price of the stock is 104 today.
4. **The option holder exercises the option. State what the option holder pays/receives.**
5. **State what the option writer (= you) pays/receives.**

5.1.4 Short American call option 2

1. You are **short an American call option**.
2. The call option has a strike of 55.
3. You sell the option to investor A at a price of 1.1.
   The stock price is 48 (on the day of sale).
4. Investor A sells the option to investor B for a price of 1.2.
   The stock price is 52 (on the day of sale).
5. Investor B sells the option to investor C for a price of 1.5.
   The stock price is 56 (on the day of sale).
6. The stock price goes up to 58.
   Investor C exercises the option. State what investor C pays/receives.
7. **State what the option writer (= you) pays/receives.**
8. **Calculate the profit of investor A.**
   Ignore interest rate compounding to answer this question.
9. **Calculate the profit of investor B.**
   Ignore interest rate compounding to answer this question.
10. **Explain how the stock price affects the profit of investor A.**
11. **Explain how the stock price affects the profit of investor B.**

5.1.5 Short European call option 1

1. You are **short a European call option**.
2. The call option has a strike of 85.
3. The market price of the stock is 88 today (= expiration date).
4. **The option holder exercises the option. State what the option holder pays/receives.**
5. **State what the option writer (= you) pays/receives.**

5.1.6 Short European call option 2

1. You are **short a European call option**.
2. The call option has a strike of 77.
3. The market price of the stock is 75 today (= expiration date).
4. **The option holder does not exercise the option.**
   State what the option holder pays/receives.
5. **State what the option writer (= you) pays/receives.**

5.1.7 Short European call option 3

1. You are **short a European call option**.
2. The call option has a strike of 55.
3. You sell the option to investor A at a price of 1.1.
   The stock price is 48 (on the day of sale).
4. Investor A sells the option to investor B for a price of 1.2.
   The stock price is 52 (on the day of sale).
5. Investor B sells the option to investor C for a price of 1.5.
   The stock price is 56 (on the day of sale).
6. The stock price goes up to 58 on the expiration date.
   Investor C exercises the option. State what investor C pays/receives.
7. **State what the option writer (= you) pays/receives.**
8. **Calculate the profit of investor A.**
   Ignore interest rate compounding to answer this question.
9. **Calculate the profit of investor B.**
   Ignore interest rate compounding to answer this question.
10. **Explain how the stock price affects the profit of investor A.**
11. **Explain how the stock price affects the profit of investor B.**

5.2 Exercise of long & short put option positions

5.2.1 Long American put option

1. You are **long an American put option**.
2. The put option has a strike of 96.
3. The market price of the stock is 91 today.
4. **You exercise the option. State what you pay/receive.**
5. **State what the option writer pays/receives.**

5.2.2 Long European put option

1. You are **long a European put option**.
2. The put option has a strike of 98.
3. The market price of the stock is 97 today (= expiration day).
4. **You exercise the option. State what you pay/receive.**
5. **State what the option writer pays/receives.**

5.2.3 Short American put option 1

1. You are **short an American put option**.
2. The put option has a strike of 66.
3. The market price of the stock is 59 today.
4. **The option holder exercises the option. State what the option holder pays/receives.**
5. **State what the option writer (= you) pays/receives.**

5.2.4 Short American put option 2

1. You are **short an American put option**.
2. The put option has a strike of 45.
3. You sell the option to investor A at a price of 1.1.
   The stock price is 48 (on the day of sale).
4. Investor A sells the option to investor B for a price of 1.2.
   The stock price is 47 (on the day of sale).
5. Investor B sells the option to investor C for a price of 1.5.
   The stock price is 46 (on the day of sale).
6. The stock price goes down to 44.
   Investor C exercises the option. State what investor C pays/receives.
7. **State what the option writer (= you) pays/receives.**
8. **Calculate the profit of investor A.**
   Ignore interest rate compounding to answer this question.
9. **Calculate the profit of investor B.**
   Ignore interest rate compounding to answer this question.
10. **Explain how the stock price affects the profit of investor A.**
11. **Explain how the stock price affects the profit of investor B.**

5.2.5 Short European put option 1

1. You are **short a European put option**.
2. The put option has a strike of 81.
3. The market price of the stock is 78 today (= expiration date).
4. **The option holder exercises the option. State what the option holder pays/receives.**
5. **State what the option writer (= you) pays/receives.**

5.2.6 Short European put option 2

1. You are **short a European put option**.
2. The put option has a strike of 66.
3. The market price of the stock is 68 today (= expiration date).
4. **The option holder does not exercise the option.**
   State what the option holder pays/receives.
5. **State what the option writer (= you) pays/receives.**

5.2.7 Short European put option 3

1. You are **short a European put option**.
2. The put option has a strike of 45.
3. You sell the option to investor A at a price of 1.1.
   The stock price is 48 (on the day of sale).
4. Investor A sells the option to investor B for a price of 1.2.
   The stock price is 47 (on the day of sale).
5. Investor B sells the option to investor C for a price of 1.5.
   The stock price is 46 (on the day of sale).
6. The stock price goes down to 44 on the expiration date.
   Investor C exercises the option. State what investor C pays/receives.
7. **State what the option writer (= you) pays/receives.**
8. **Calculate the profit of investor A.**
   Ignore interest rate compounding to answer this question.
9. **Calculate the profit of investor B.**
   Ignore interest rate compounding to answer this question.
10. **Explain how the stock price affects the profit of investor A.**
11. **Explain how the stock price affects the profit of investor B.**

5.3 Exercise of cash settled option positions

- Not all options involve delivery of stock.
- Options on stock indices are settled in cash.
- All of the options below are on stock indices and the strike is 1000 index points.
- All of the options below pay \$100 per index point that the option is in the money.

5.3.1 Long cash-settled call option

1. You are **long a call option (American or European) on a stock index**.
2. The value of the stock index is 1050 today (= expiration day).
3. **You exercise the option. State what you pay/receive.**
4. **State what the option writer pays/receives.**

5.3.2 Short cash-settled call option

1. You are **short a call option (American or European) on a stock index**.
2. The value of the stock index is 1075 today (= expiration day).
3. **The option holder exercises the option. State what the option holder pays/receives.**
4. **State what the option writer (= you) pays/receives.**

5.3.3 Long cash-settled put option

1. You are **long a put option (American or European) on a stock index**.
2. The value of the stock index is 925 today (= expiration day).
3. **You exercise the option. State what you pay/receive.**
4. **State what the option writer pays/receives.**

5.3.4 Short cash-settled put option

1. You are **short a put option (American or European) on a stock index**.
2. The value of the stock index is 940 today (= expiration day).
3. **The option holder exercises the option. State what the option holder pays/receives.**
4. **State what the option writer (= you) pays/receives.**