**Problem 13.25.**

*Consider an option on a non-dividend-paying stock when the stock price is $30, the exercise price is $29, the risk-free interest rate is 5% per annum, the volatility is 25% per annum, and the time to maturity is four months.*

1. *What is the price of the option if it is a European call?*
2. *What is the price of the option if it is an American call?*
3. *What is the price of the option if it is a European put?*
4. *Verify that put–call parity holds.*   
     
   In this case , , ,  and 









1. The European call price is



or $2.52.

1. The American call price is the same as the European call price. It is $2.52.
2. The European put price is



or $1.05.

1. Put-call parity states that:



In this case , , ,  and  and it is easy to verify that the relationship is satisfied,

**Problem 13.26.**

*Assume that the stock in Problem 13.25 is due to go ex-dividend in 1.5 months. The expected dividend is 50 cents.*

1. *What is the price of the option if it is a European call?*
2. *What is the price of the option if it is a European put?*
3. *Use the results in the Appendix to this chapter to determine whether there are any circumstances under which the option is exercised early.*
4. The present value of the dividend must be subtracted from the stock price. This gives a new stock price of:



and







The price of the option is therefore



or $2.21.

1. Because



the value of the option when it is a European put is



or $1.22.

1. If  denotes the time when the dividend is paid:



This is less than the dividend. Hence the option should be exercised immediately before the ex-dividend date for a sufficiently high value of the stock price.

**Problem 13.14.**

*What is the price of a European put option on a non-dividend-paying stock when the stock price is $69, the strike price is $70, the risk-free interest rate is 5% per annum, the volatility is 35% per annum, and the time to maturity is six months?*   
  
In this case , , ,  and .



The price of the European put is







**Problem 15.9.**

*A foreign currency is currently worth $1.50. The domestic and foreign risk-free interest rates are 5% and 9%, respectively. Calculate a lower bound for the value of a six-month call option on the currency with a strike price of $1.40 if it is (a) European and (b) American.*   
  
Lower bound for European option is



Lower bound for American option is



**Problem 15.10.**

*Consider a stock index currently standing at 250. The dividend yield on the index is 4% per annum, and the risk-free rate is 6% per annum. A three-month European call option on the index with a strike price of 245 is currently worth $10. What is the value of a three-month put option on the index with a strike price of 245?*   
  
In this case , , , , , and . Using put–call parity



or



Substituting:



The put price is 3.84.

**Problem 15.11.**

*An index currently stands at 696 and has a volatility of 30% per annum. The risk-free rate of interest is 7% per annum and the index provides a dividend yield of 4% per annum. Calculate the value of a three-month European put with an exercise price of 700.*   
  
In this case , , , ,  and . The option can be valued using equation (15.5).



and



The value of the put, , is given by:



i.e., it is $40.6.