Department of Economics
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Spring 2000
Professor Pierce

Economics 136
Problem Set #4
(Due in Lecture Tuesday, March 21)

1. Draw payoffs of following combinations of options. All the options have the same expiration date.

(a) Buying a call and a put with the same strike price.

(b) Buying a call and two puts with the same strike (this is called a *strip*).

(c) Buying a put with a strike price, X_1, and a call with a strike price, X_2, where $X_1 < X_2$ (called a *strangle*).

(d) Buying a call with a strike price, X_1, a call with a strike price, X_3, and selling two calls with a strike price, X_2, where $X_1 < X_2 < X_3$ and $X_3 - X_2 = X_2 - X_1$ (a *butterfly spread*).

2. ACME Corp. stock currently trades at $25 a share. Next year it will either trade at $35 or $15. The stock will pay no dividends, and the risk-free one-year interest rate is 10%.

(a) What is the price of a European Call option with a strike price of $25? If the strike price were $0 instead, how would that change your answer. Explain.

(b) Redo part (a) for a put option.

(c) Suppose the stock will be worth either $40 or $10 next year. What would be the price of a call option with a strike price of $25. Explain intuitively.

(d) Redo part (c) with a risk-free rate of 15%. Explain your result intuitively.

3. You have been looking at buying stock in the newspaper company – The Daily Granite. By studying it you have ascertained that the payoffs and probabilities of those payoffs next year will be:

State	Probabilities	Price of Daily Granite stock tomorrow
1	1/5	$120
2	1/5	$110
3	1/5	$100
4	1/5	$90
5	1/5	$80

You have the opportunity today to buy a call or put option on Daily Granite stock with a strike price of $110.

(a) What are the payoffs for the call option in each state.

(b) What are the payoffs for the put option in each state.

(c) Graph the payoffs for each option (price of stock on x-axis and payoff of option on the y-axis)

(d) Using payoffs of a stock, a call and a put from above, show how you can make a risk-free portfolio.

4. The current price of one share Widgets U.S.A. stock is $50. It's expected that Widgets will have a return of %10 and a standard deviation of 60% over the next year. The risk-free rate is 5%. :

(a) Use the Black-Scholes formula (consult section 21.4 of BKM) to calculate the price of a call option on Widgets stock with an exercise price of $60 expiring in one year.

(b) Redo part (a) for a similar option that expires in two years. Explain your result intuitively.

(c) Redo part (a) for a put option with the same terms.