

**Problem set 4 M DUE IN CLASS MONDAY, DECEMBER 8**

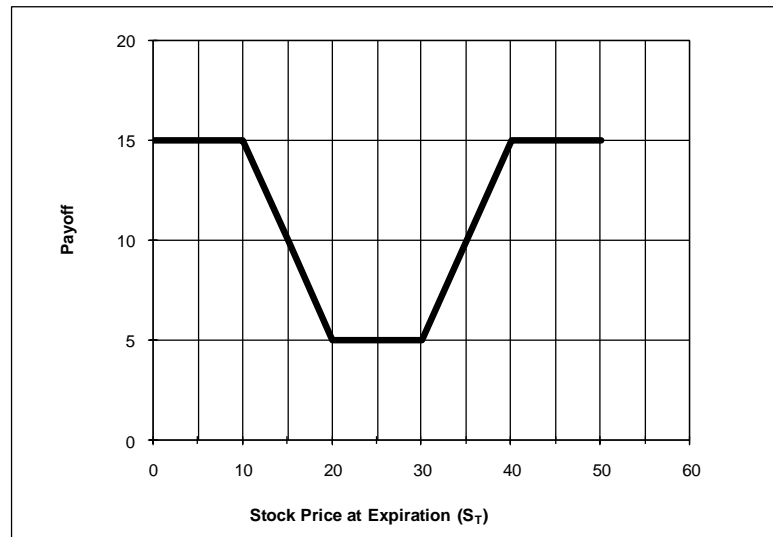
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Although you may discuss these problems with others, you should calculate everything yourself (just to make sure that you can get your calculator to give the same answers that everyone else is getting). Your solutions must be written up by yourself: you must turn in the original. If you won't be in class on the day the problem set is due, you can fax me a pdf, and turn in the original at the next meeting.

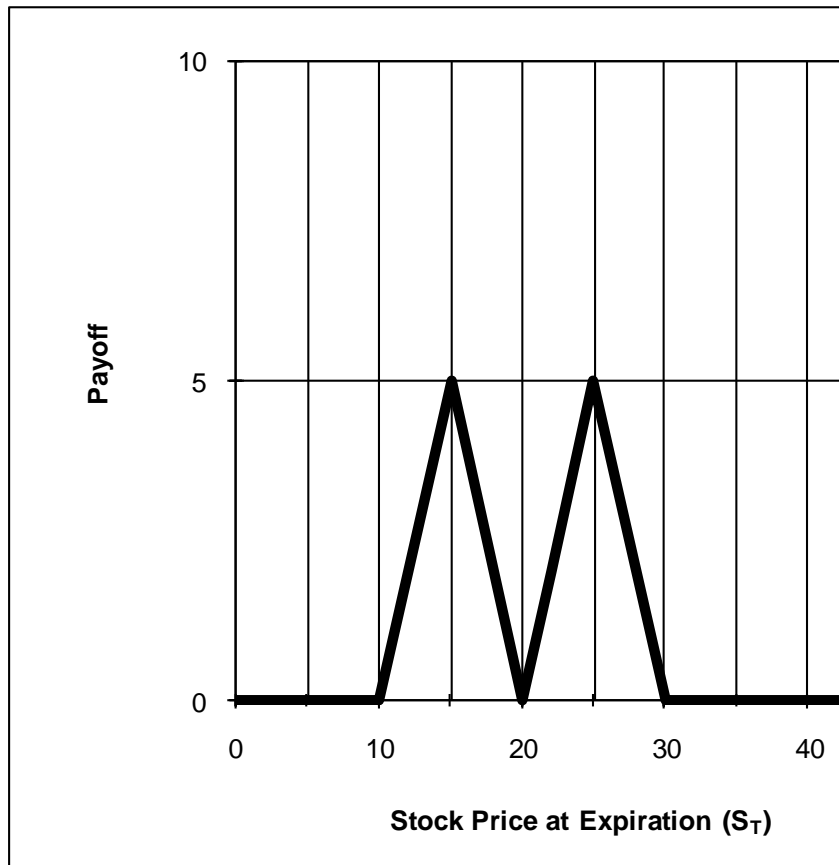
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1. Graph the payoff to a portfolio consisting of:
  - a. Short one put with  $X=10$
  - b. Long one put with  $X=20$
  - c. Long one call with  $X=30$
  - d. Short one call with  $X=40$
  - e. Long one bond with par value 5.

Answer:



2. The payoff function of an “M-for-Monday” strategy is



How would you form a portfolio that will give this payoff? You can use whatever combination of puts, calls, bonds or underlying you wish, and anything can be held long or short. (Hint: you can generate this payoff function using only calls, or using only puts. If you are using only calls, work from left to right; if you are using only puts, work from right to left.)

Answer:

Security	X	Amt
Call: X=	10	1
Call: X=	15	-2
Call: X=	20	2
Call: X=	25	-2
Call: X=	30	1

3. MCL stock is currently trading at 30; and it has a volatility of  $\sigma=0.25$ . Consider a call option with  $X=35$  and  $T=2$  years. The risk-free rate is 7% (continuously compounded annual rate).
- According to the Black-Scholes formula, what is the value of the call option? (In addition to  $C$ , show the following intermediate quantities:  $d_1$ ,  $d_2$ ,  $N(d_1)$ ,  $N(d_2)$ )
  - If the equities desk at a bank has just written this call (size=10,000 shares), how many shares should they be long or short to be hedged?
  - Using put-call parity, what should be the price of a European put option with  $X=35$  and  $T=2$ ?

Call	4.029
Put	4.457
Bond	30.428
d1	0.137
N(d1)	0.554
d2	-0.217
N(d2)	0.414

The hedge ratio is 0.554; the bank should be long 5,540 shares

<del>Call</del>	<del>\$4.865</del>
<del>Put</del>	<del>\$5.292</del>
<del>Bond</del>	<del>\$30.428</del>
<del>d<sub>1</sub></del>	<del>0.1788</del>
<del>N(d<sub>1</sub>)</del>	<del>0.5709</del>
<del>d<sub>2</sub></del>	<del>-0.2455</del>
<del>N(d<sub>2</sub>)</del>	<del>0.4030</del>

~~The hedge ratio is 0.5709; the bank should be short 5,709 shares.~~