For the following questions use the attached futures and options data. Assume historical expected basis of -$0.30 per bushel and a commission of $0.01 per bushel for both crops. **Show the math and draw the graph.**

1. A speculator buys a $5.00 put option on Dec. 2013 corn futures. What does she pay for the option? At what price does she breakeven (where her return is equal to zero)? If the Dec. 2013 corn futures price falls to $4, what is her return?

She pays the $0.23 premium and the $0.01 commission for a total of $0.24
Her breakeven price is equal to
\[
\text{Strike Price} - \text{Premium} - \text{Commission} = $5.00 - $0.23 - $0.01 = $4.76
\]
If the Dec. 2012 corn futures price falls to $4, her return is:
\[
\text{Max}(0, \text{Strike Price} - \text{Futures Price}) - \text{Premium} - \text{Commission} = \text{Max}(0, $5.00 - $4.00) - $0.23 - $0.01 = \text{Max}(0, $1.00) - $0.23 - $0.01 = $1.00 - $0.23 - $0.01 = $0.76
\]
2. A hedger (producer) buys a $5.00 put option on Dec. 2013 corn futures. What is her floor price with the option in place? If the Dec. 2013 corn futures price falls to $4, what is her net price?

Floor Price = Strike Price + Basis – Premium – Commission
= $5.00 - $0.30 - $0.23 - $0.01
= $4.46

If the Dec. 2012 corn futures price falls to $4, her net price is equal to her floor price, $4.46. To see this, look at the graph. She receives $3.70 from the cash market ($4.00 - $0.30, futures + basis) and she receives $0.74 from the put option (see the return from put option in question 1).
3. Instead of buying that $5.00 put option, the hedger does a short hedge. What is her floor price with the short hedge in place? If the Dec. 2013 corn futures price falls to $4, what is her net price?

Floor price with a short hedge is the expected price with a short hedge.

Expected Price = Futures Price + Basis – Commission

= $5.60 - $0.30 - $0.01

= $5.29

If the Dec. 2012 corn futures price falls to $4, her net price is $5.29.
4. If the speculator in question 1 also sold a $7.00 call option on Dec. 2013 corn futures, does that change her breakeven price? If so, what is the new breakeven price? How has her risks changed?

Yes, her breakeven price changed. From question 1, her original breakeven price was $4.76. The change is due to selling the call option. Her new breakeven price is equal to her old breakeven price plus the premium she receives on the call minus the commission.

New Breakeven Price = Old Breakeven Price + Call Option Premium – Commission

= $4.76 + $0.13 - $0.01

= $4.88

Her risks have changed because she now faces bigger losses if prices rise above $7.
5. If the hedger in question 2 also sold a $7.00 call option on Dec. 2013 corn futures, does that change her floor price? If so, what is the new floor price? How has her risks changed?

Yes, her floor price changed with the addition of the call option premium less the commission.

New Floor Price = Old Floor Price + Call Option Premium - Commission

= $4.46 + $0.13 - $0.01 = $4.58

Her risks have changed. She has a slightly higher floor, but limited upside potential as the call creates a ceiling once the futures price moves above $7.
6. A speculator buys a $6.00 call option on Dec. 2013 corn futures. What does she receive for the option? At what price does she breakeven? If the Dec. 2013 corn futures price falls to $4, what is her return? If the Dec. 2013 corn futures price rises to $7, what is her return?

Actually she pays for the option, Premium + Commission, $0.35 + $0.01. So she pays $0.36. Her breakeven price is equal to:

\[
\text{Strike Price} + \text{Premium} + \text{Commission} = $6.00 + $0.35 + $0.01 = $6.36
\]

Her return is:

\[
\max(0, \text{Futures Price} - \text{Strike Price}) - \text{Premium} - \text{Commission}
\]

At $4 futures, her return is:

\[
\max(0, $4.00 - $6.00) - $0.35 - $0.01 = \max(0, -$2.00) - $0.35 - $0.01 = 0.00 - $0.35 - $0.01 = -$0.36
\]

At $7 futures, her return is:

\[
\max(0, $7.00 - $6.00) - $0.35 - $0.01 = \max(0, $1.00) - $0.35 - $0.01 = $1.00 - $0.35 - $0.01 = $0.64
\]

\[\text{Return/Net Price}\]

\[
\begin{array}{ccccccccccc}
\text{Call} & \text{Futures Price} & $0.00 & $1.00 & $2.00 & $3.00 & $4.00 & $5.00 & $6.00 & $7.00 & $8.00 & $9.00 & $10.00 \\
\text{Return/Net Price} & $0.00 & $0.00 & $0.00 & $0.00 & $0.00 & $0.00 & $0.00 & $0.00 & $0.00 & $0.00 & $0.00 & $0.00 \\
\end{array}
\]
7. A hedger (processor) buys a $6.00 call option on Dec. 2013 corn futures. What is her ceiling price with the option in place? If the Dec. 2013 corn futures price falls to $4, what is her net price?

Ceiling Price = Strike Price + Basis + Premium + Commission
= $6.00 - $0.30 + $0.35 + $0.01
= $6.06

If the Dec. 2012 corn futures price falls to $4, her option will expire worthless and her net price is:

Net Price = Cash + Premium + Commission
= Futures + Basis + Premium + Commission
= $4.00 - $0.30 + $0.35 + $0.01
= $4.06

Return/Net Price

Call

Net

Cash

Futures Price

Futures

Futures Price

Futures

Futures
All prices and premiums are listed in dollars per bushel

Dec. 2013 Corn Futures

<table>
<thead>
<tr>
<th>Options</th>
<th>Strike Price</th>
<th>Premium</th>
<th>Options</th>
<th>Strike Price</th>
<th>Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Put</td>
<td>5.00</td>
<td>0.23</td>
<td>Call</td>
<td>5.00</td>
<td>0.86</td>
</tr>
<tr>
<td>Put</td>
<td>5.10</td>
<td>0.36</td>
<td>Call</td>
<td>5.10</td>
<td>0.79</td>
</tr>
<tr>
<td>Put</td>
<td>5.20</td>
<td>0.30</td>
<td>Call</td>
<td>5.20</td>
<td>0.73</td>
</tr>
<tr>
<td>Put</td>
<td>5.30</td>
<td>0.34</td>
<td>Call</td>
<td>5.30</td>
<td>0.67</td>
</tr>
<tr>
<td>Put</td>
<td>5.40</td>
<td>0.38</td>
<td>Call</td>
<td>5.40</td>
<td>0.61</td>
</tr>
<tr>
<td>Put</td>
<td>5.50</td>
<td>0.43</td>
<td>Call</td>
<td>5.50</td>
<td>0.56</td>
</tr>
<tr>
<td>Put</td>
<td>5.60</td>
<td>0.48</td>
<td>Call</td>
<td>5.60</td>
<td>0.51</td>
</tr>
<tr>
<td>Put</td>
<td>5.70</td>
<td>0.54</td>
<td>Call</td>
<td>5.70</td>
<td>0.47</td>
</tr>
<tr>
<td>Put</td>
<td>5.80</td>
<td>0.59</td>
<td>Call</td>
<td>5.80</td>
<td>0.43</td>
</tr>
<tr>
<td>Put</td>
<td>5.90</td>
<td>0.65</td>
<td>Call</td>
<td>5.90</td>
<td>0.39</td>
</tr>
<tr>
<td>Put</td>
<td>6.00</td>
<td>0.72</td>
<td>Call</td>
<td>6.00</td>
<td>0.35</td>
</tr>
<tr>
<td>Put</td>
<td>6.10</td>
<td>0.79</td>
<td>Call</td>
<td>6.10</td>
<td>0.32</td>
</tr>
<tr>
<td>Put</td>
<td>6.20</td>
<td>0.85</td>
<td>Call</td>
<td>6.20</td>
<td>0.29</td>
</tr>
<tr>
<td>Put</td>
<td>6.30</td>
<td>0.93</td>
<td>Call</td>
<td>6.30</td>
<td>0.26</td>
</tr>
<tr>
<td>Put</td>
<td>6.40</td>
<td>1.00</td>
<td>Call</td>
<td>6.40</td>
<td>0.24</td>
</tr>
<tr>
<td>Put</td>
<td>6.50</td>
<td>1.08</td>
<td>Call</td>
<td>6.50</td>
<td>0.22</td>
</tr>
<tr>
<td>Put</td>
<td>6.60</td>
<td>1.16</td>
<td>Call</td>
<td>6.60</td>
<td>0.20</td>
</tr>
<tr>
<td>Put</td>
<td>6.70</td>
<td>1.24</td>
<td>Call</td>
<td>6.70</td>
<td>0.18</td>
</tr>
<tr>
<td>Put</td>
<td>6.80</td>
<td>1.32</td>
<td>Call</td>
<td>6.80</td>
<td>0.16</td>
</tr>
<tr>
<td>Put</td>
<td>6.90</td>
<td>1.40</td>
<td>Call</td>
<td>6.90</td>
<td>0.14</td>
</tr>
<tr>
<td>Put</td>
<td>7.00</td>
<td>1.49</td>
<td>Call</td>
<td>7.00</td>
<td>0.13</td>
</tr>
</tbody>
</table>