1. Answer these questions with YES or NO.

a) Can a covariance ever be negative?  YES 

b) Can a covariance ever be larger than 1?  YES 

c) If the covariance between X and Y is negative, must the correlation coefficient between X and Y also be negative?  YES 

2. Consider two discrete random variables X and Y with joint pmf given in the following table:

<table>
<thead>
<tr>
<th></th>
<th>y = -1</th>
<th>y = 0</th>
<th>y = 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>x = 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>x = 0</td>
<td>.25</td>
<td>.25</td>
<td>0</td>
</tr>
<tr>
<td>x = 1</td>
<td>0</td>
<td>.25</td>
<td>0</td>
</tr>
</tbody>
</table>

a) Determine the covariance between X and Y.  Show how you calculate this value.

E(XY) = (-1)(-1)(0) + (-1)(0)(.25) + (-1)(1)(0) 
+ (0)(-1)(.25) + (0)(0)(0) + (0)(1)(.25) 
+ (1)(-1)(0) + (1)(0)(.25) + (1)(1)(0) = 0

E(X) = (-1)(.25) + (0)(.5) + (1)(.25) = 0

E(Y) = (-1)(.25) + (0)(.5) + (1)(.25) = 0

Cov(X,Y) = E(XY) – E(X)E(Y) = 0 – (0)(0) = 0

b) Are X and Y independent random variables?  Explain.

No.  If X and Y were independent, then the joint pmf would equal the product of the two marginal pmfs for all values of x and y.  But this is true for none of the possible values of x and y.  For example, Pr(X = 0, Y = 0) = 0, but Pr(X = 0)Pr(Y = 0) = (.5)(.5) = .25.