Given a table

$p(x,y)$	$x=1$	$x=2$	$x=3$	$p(y)$
$y=1$	$\frac{1}{16}$	$\frac{3}{8}$	$\frac{1}{16}$	$\frac{1}{2}$
$y=2$	$\frac{1}{16}$	$\frac{3}{16}$	0	$\frac{1}{4}$
$y=3$	0	$\frac{3}{16}$	$\frac{1}{16}$	$\frac{1}{4}$
$p(x)$	$\frac{1}{8}$	$\frac{3}{4}$	$\frac{1}{8}$	1

- Find

1. Entropies $H(X), H(Y)$
2. Conditional Entropies $H(X|Y)$ and $H(Y|X)$
3. Joint Entropy $H(X,Y)$
4. Mutual Information $I(X;Y)$
5. Realise that $p(y)$ and $p(x)$ is the sum of the row and column respectively. This is not likely to be provided to you. The formula for each is

$$H(X) = \sum_{i=1}^{n} p(x_i) log_2 p(x_i)$$

and

$$H(Y) = \sum_{i=1}^{n} p(y_i) log_2 p(y_i)$$

in this case, i is 3 for both as there are 3 rows and columns, this may differ. You will need to manually sum with each $p(x)$ and $p(y)$ to get your answers.

6. In order to get $H(X|Y)$ and $H(Y|X)$ we can use $H(X,Y)$, see step 3 for the answers to step 2 and 3.
7. To find $H(X,Y)$ sum all values in the table in the form

$$-\sum_{i=1}^{n}\sum_{j=1}^{n} p(x_i, y_j) log_2 p(x_i, y_j)$$

For example, $p(x_1, y_1)$ would be $\frac{1}{16}$ (top-left cell) according to the table.
In order to find $H(X|Y)$ and $H(Y|X)$ use the formula below:

$$H(X|Y) = H(X,Y) - H(Y)$$

$$H(Y|X) = H(X,Y) - H(X)$$

8. To find I(X;Y) you can use any of the below formulae

$$\begin{aligned} I(X;Y) &\equiv H(X) - H(X|Y) \\ &\equiv H(Y) - H(Y|X) \\ &\equiv H(X) + H(Y) - H(Y,X) \\ &\equiv H(X,Y) - H(Y|X) - H(X|Y) \end{aligned}$$

$$I(X;Y) = D_{\mathrm{KL}}(P(X,Y) \| P(X)P(Y)) = 0$$