Homework 3

Introduction to Data Science (QR2)

due: **10/1/25**

Instructions: Please submit solutions on Populi. Only a knitted pdf of an `Rmarkdown` file will be accepted.

Problem 1: Suppose a person is randomly drawn from a large population and tested for COVID-19.

Let $D = 1$ if the person has COVID-19 and 0 otherwise.
Let $T = 1$ if the person tests positive and 0 otherwise.

Suppose:

$P(D = 0) = .99$.
$P(T = 1 \mid D = 0) = .01$.
$P(T = 1 \mid D = 1) = .97$.

a. Draw the diagram depicting the marginal of D and the conditional of $T \mid D$.
(the one that branches as you go left to right).

b. Give the joint distribution of D and T in the two way table format.

c. What is $P(D = 1 \mid T = 1)$?

Problem 2: This problem is named after the host of the long running TV show *Let's Make a Deal*. There has been a vigorous debate about what the correct answer is!

A contestant must choose one of three closed doors.
There is a prize (typically a car) behind one of the three doors.
Behind the other two doors, there is something worthless (traditionally a goat).
After the contestant chooses one of the three doors, Monty opens one of the other two, revealing a goat (never the car!).
There are now two closed doors.
The contestant is asked whether he would like to switch from the door he initially chose to the other closed door.

The contestant will get whatever is behind the door he has finally chosen.
Should he switch?

Problem 3: Which bands come to ACL Fest? Austin City Limits is right around the corner! Complete the following case study using data (← link on our course website) from bands that have performed at the top music festivals.