CSCI 378 HW6

Consider the "blood types" example from the lecture notes with the following variables:

$\dot{R}, \dot{S}, \dot{T}$: Rhonda, Sam, and Tim's genotype (respectively)
R, S, T: Rhonda, Sam, and Tim's blood type (respectively)

Let's include one more variable E that indicates how Tim's genes were inherited:

$$E = \begin{cases} 11 & \text{if Tim inherited Rhonda's alphabetically first gene and Sam's alphabetically first gene} \\ 12 & \text{if Tim inherited Rhonda's alphabetically first gene and Sam's alphabetically second gene} \\ 21 & \text{if Tim inherited Rhonda's alphabetically second gene and Sam's alphabetically first gene} \\ 22 & \text{if Tim inherited Rhonda's alphabetically second gene and Sam's alphabetically second gene} \end{cases}$$

(a) Create a functional causal model $M = (U, V, F)$ for this example where $U \cup V = \{\dot{R}, \dot{S}, \dot{T}, R, S, T, E\}$. Remember to specify the functions in F, not just the graph.

(b) Suppose the following probability distribution for blood genotypes in the general population:

genotype	prob
AA	.1
AB	.05
AO	.2
BB	.1
BO	.15
OO	.4

Also suppose that it is equally likely to inherit either of a parent's genes.

Extend your functional causal model from (a) to a probabilistic causal model.

(c) Using the PCM in (b), compute the probability that Rhonda, Sam, and Tim all have type AB blood.