Präsenzaufgabe 3&4

Exercise 1 There are two types of twins: identical twins (I) who have the same genes, and fraternal twins (F) who have different genes in general. For this exercise, for each traditional pregnancy (not using Assisted Reproductive Technology, or ART), we consider that the odds of having a pair of identical twins to be $\mathbb{P}(I) = 0.4\%$ and the odds of having a pair of fraternal twins is $\mathbb{P}(F) = 1.1\%$.

a) A couple has a pregnancy, what is the probability of them having a pair of twins (of any type)?

b) From now on we assume that they had a pair of twins. Knowing that, what is the probability that both twins are *girls*? (⚠see warning below)

c) What is the probability that at least one of the twins is a girl?

d) Knowing that they had 2 girls, what is the probability that they are identical twins?

e) The use of ART (Assisted Reproductive Technology) can drastically increase the probability of twins. For this exercise we assume that with ART, the probability of fraternal twins becomes $\mathbb{P}(F) = 30\%$ (the probability of identical twins stays the same). Knowing that the couple is using ART and has a pair of twins, what is the probability of having 2 girls?

f) In France, the proportion of pregnancies using ART is $\mathbb{P}(ART) = 2\%$. A couple of friends from France just had a pair of twin girls. Knowing all this, what is the probability that they used ART?

g) Same question, but assuming they had a girl and a boy.

⚠**Assumptions:** To simplify answers, we work under the following (wrong) assumptions: by *girl* and *boy* we mean *assigned female at birth* (AFAB) and *assigned male at birth* (AMAB) respectively. We assume the odds of a baby being AFAB to be 50% and AMAB to be 50% (in actuality roughly 0.05% of babies do not have an unambiguous sex assigned at birth, in some of these cases sex assignment can be deferred or requires more diagnostic steps, also AFAB and AMAB are not equally probable in reality). We assume that AFAB and AMAB are purely dependent on genotype, so identical twins would always have the same sex assigned at birth, while the probabilities of AFAB and AMAB of two fraternal twins are considered independent.

Exercise 2 When I go fishing, the number of fishes I catch follows a Poisson law with 2 average fish per hour. Show that the number of fish I catch in 2 hours also follows a Poisson law.