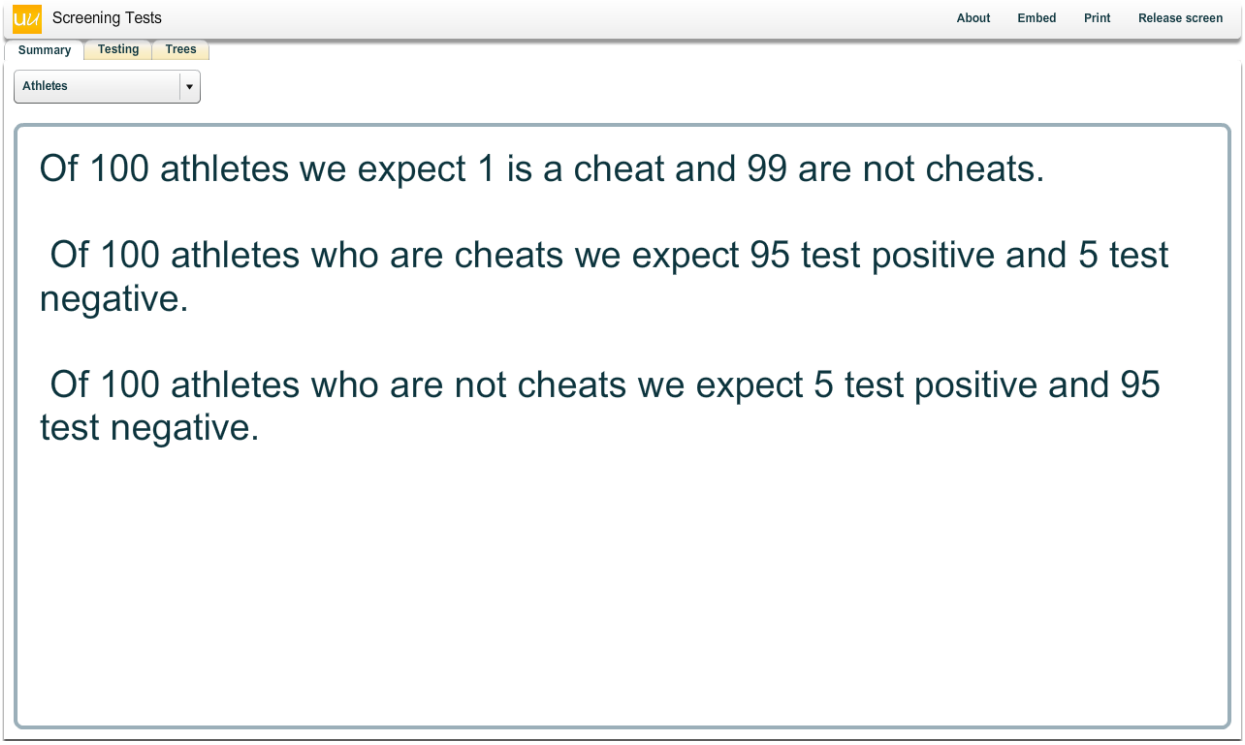
The Rare Event & False Positives

The classic problem of the rare event and of drawing inappropriate conclusions (often false positives) is described in most S1 textbooks , and it is one that students studying statistic should meet. The context can be testing athletes for drugs, efficacy of a treatment, screening for a rare disease among others.
On the understandinguncertainty web-site there is a free resource which illuminates this classic problem in a variety of contexts in new way, and makes for the basis of an interesting lesson. The animations avoid using the word probability and uses frequencies based on a set of 100 people – this certainly clarifies a complicated situation for a non-mathematical audience and is available for organisations to down load and use, often by medics. This approach may help your students' understanding as well, but they will need to use probabilities in exams – how you combine the two approaches is your judgement.

http://understandinguncertainty.org/files/animations/BayesTheorem1/BayesTheorem.html

1. The scenario

A drugs test for athletes which correctly identifies both those with illegal drugs in their system and innocent athletes 95% of the time.



Discuss 'Is the system fair to all?'

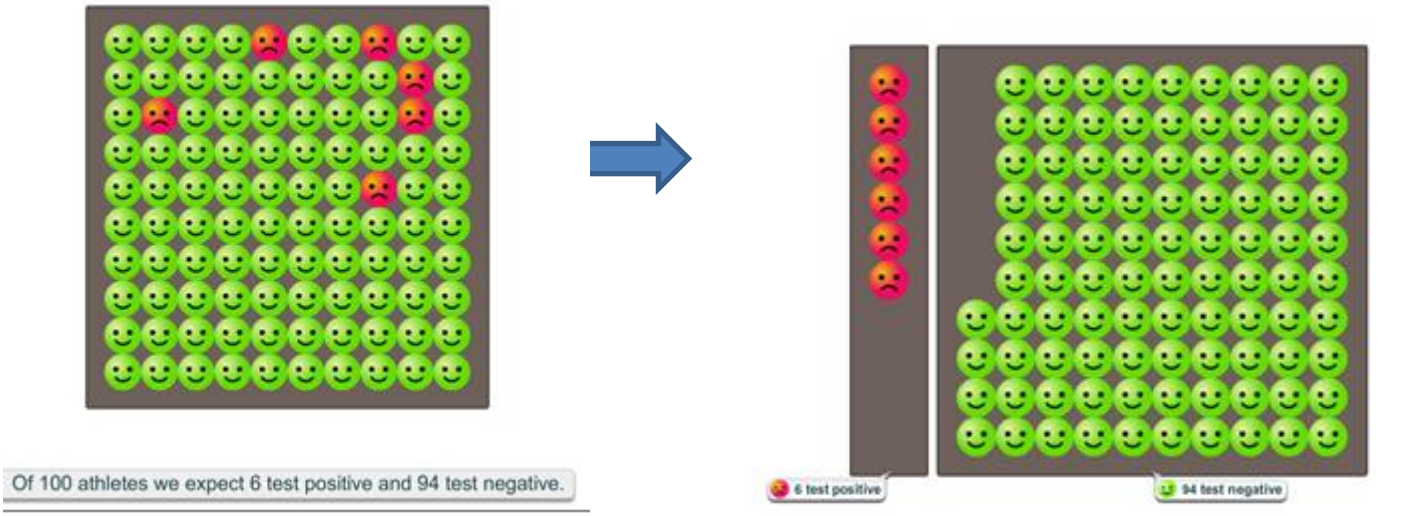
Ask your students to estimate (or calculate) probabilities that interest them, these could include

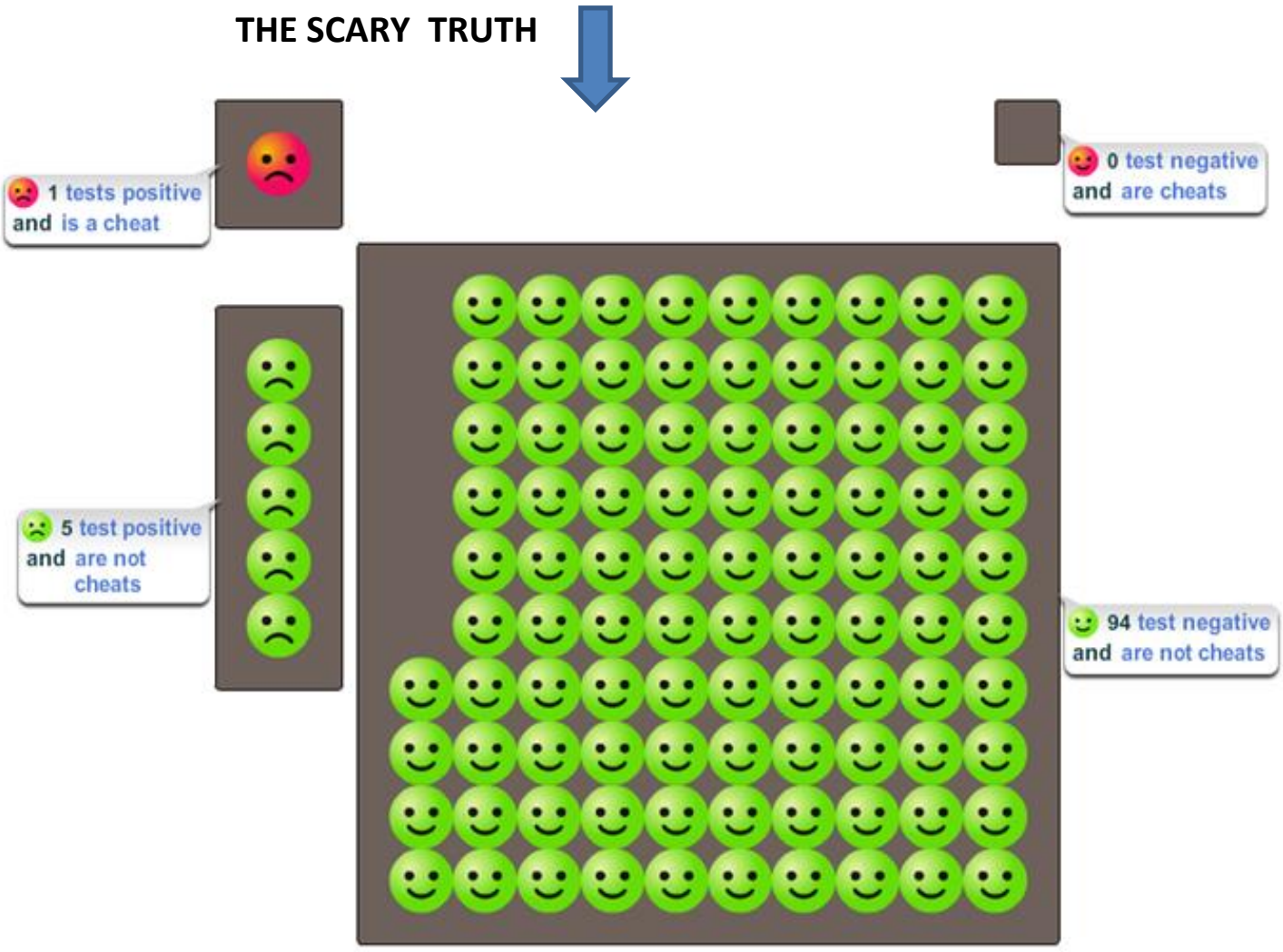
i) the probability that an innocent athlete tests positive for illegal drugs

ii) the probability that an athlete who tested positive for illegal drugs was in fact innocent

iiI) the probability that an athlete who tested negative for illegal drugs had been cheating

2. The animation illustrating the problem





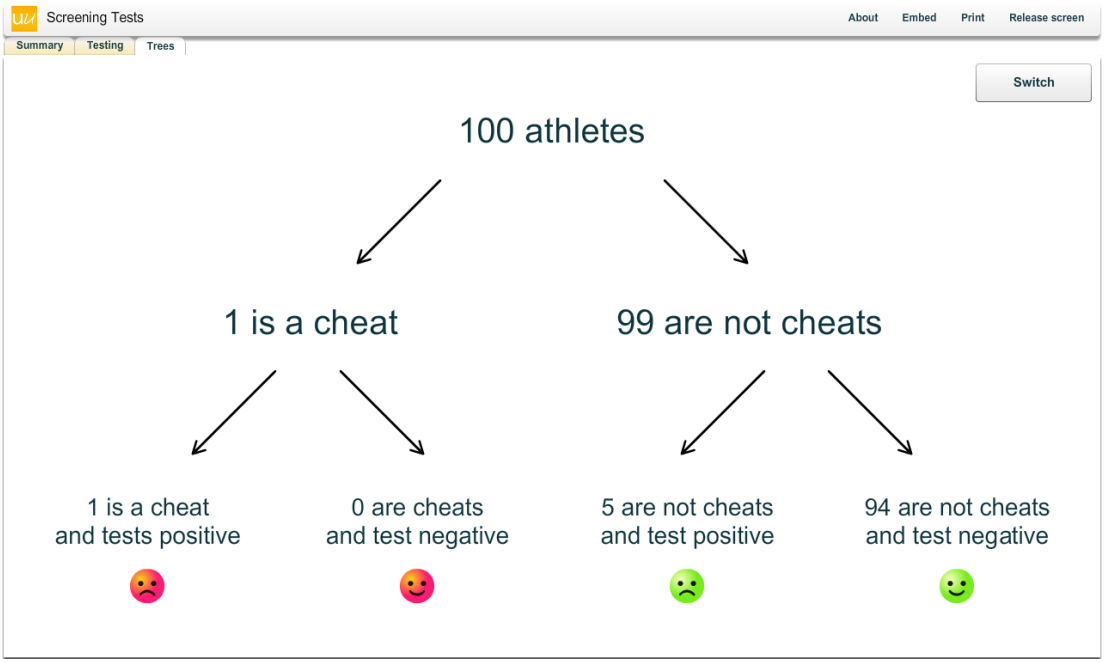
Questions:

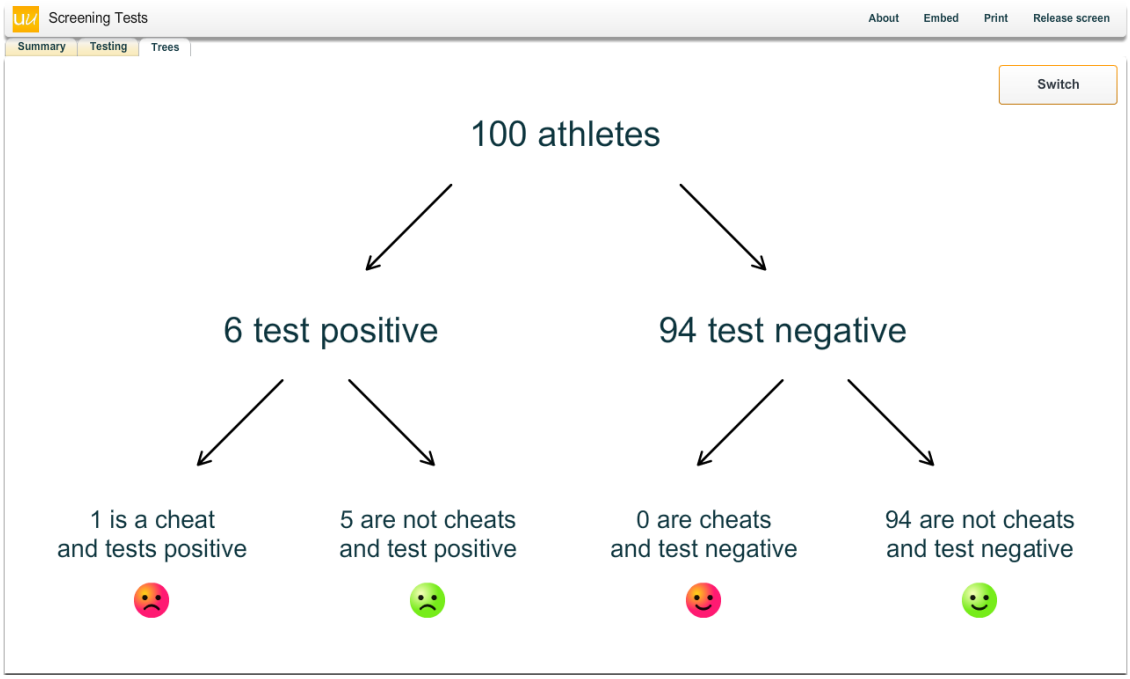
- How were the frequencies arrived at?
- Does this agree with our predictions?
- How would the situation change if the test was 99% accurate? 99.9% ?

3. Looking at the situation differently – animation

Question:

if you drew a tree diagram does switching which event comes first (testing or cheating) make any difference to the outcomes?





So plenty to promote thinking here ….

Also see https://nrich.maths.org/9886 *Great Expectations: Probability through Problems* for more ideas on teaching probability.