Who is cheating?

nrich
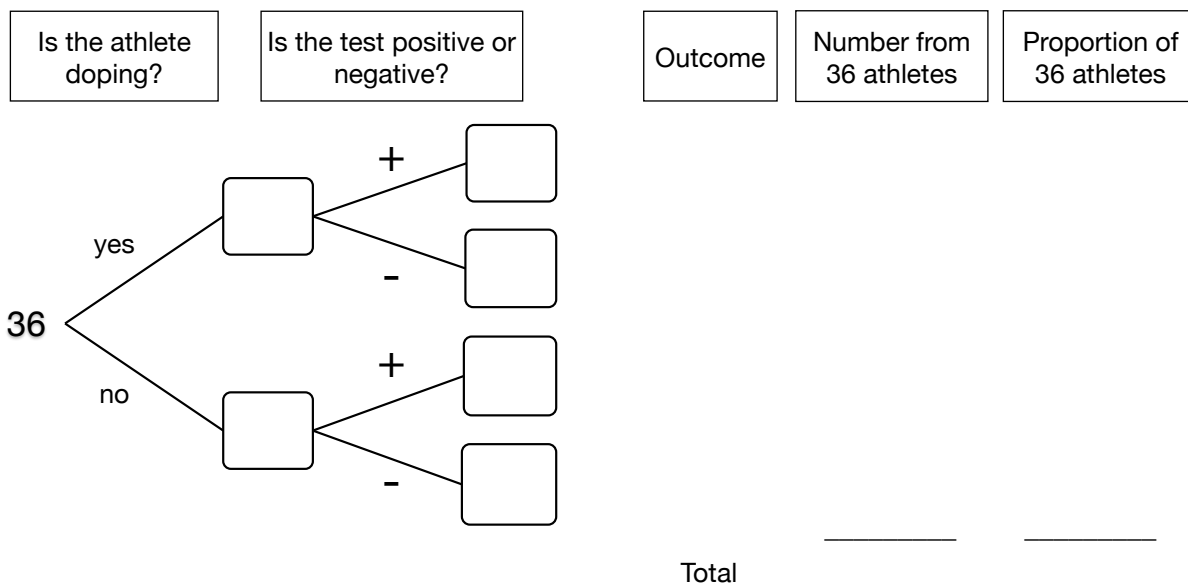
How do the observed results compare with what we might expect?

Complete the tree diagram below to show what we would **predict for 36 athletes**.
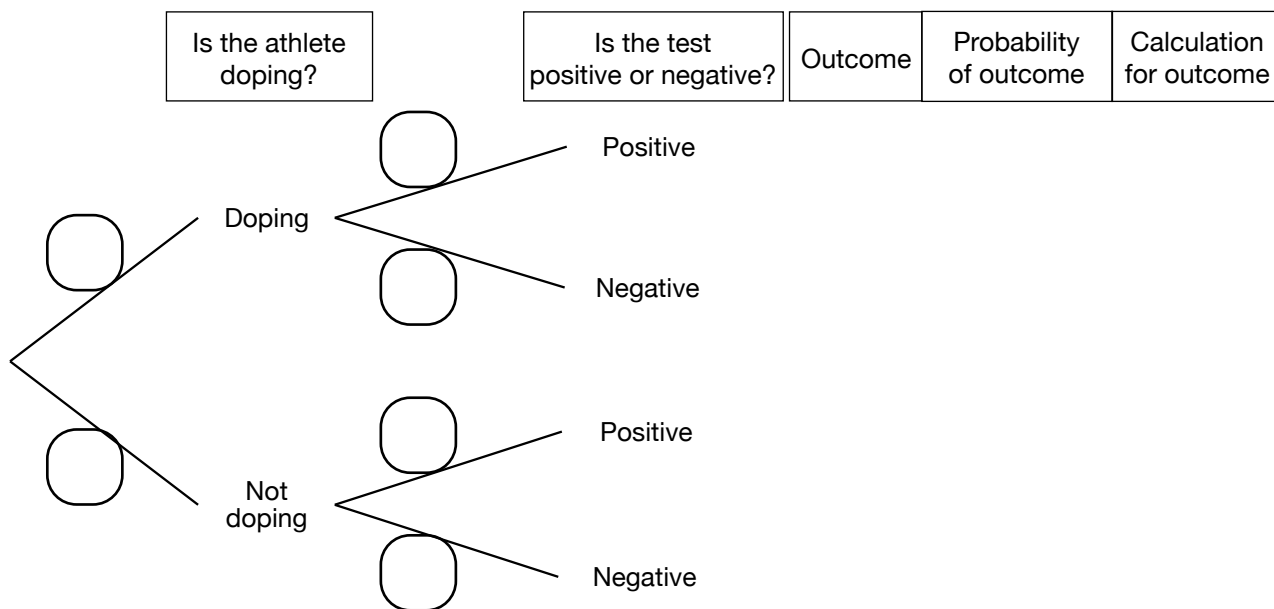
How do your predicted results compare with your experimental data?

| Is the athlete doping? | Is the test positive or negative? | | Outcome | Number from 36 athletes | Proportion of 36 athletes |

```
                          +   ┌──┐
                    ┌──┐ ╱     └──┘
              yes  ╱└──┘╲
                 ╱       -   ┌──┐
   36 ╱╲                      └──┘
      ╲                   +   ┌──┐
       ╲   no  ╱┌──┐╲          └──┘
        ╲────╱ └──┘ ╲
                     -  ┌──┐
                         └──┘
```

Total   _____   _____

		Is the test positive or negative?		
		+	-	Total
Is the athlete doping?	Y			
	N			
Total				

6. How many of the 36 athletes would you **expect** to test **positive**, given that they had been taking the banned substance?

   ....

7. How many of the 36 athletes would you **expect** to test **positive** in total?

   ....

8. Why are these two answers different?

   ....

9. How many of the 36 athletes would you **expect** to test **negative**, given that they had **not** been taking the banned substance?

   ....

10. How many of the 36 athletes would you **expect** to test **negative** in total?

    ....

11. Why are these two answers different?

    ....

On this tree diagram, put the probability (expected proportion) for each event on the appropriate branch. Then complete the 'Outcome' and 'Probability' columns **using the previous tree diagram or 2-way table**.

Is the athlete doping?		Is the test positive or negative?	Outcome	Probability of outcome	Calculation for outcome

Doping

Positive

Negative

Not doping

Positive

Negative

We can use the expected proportions for each outcome to find a general rule for calculating probabilities from a tree diagram:

First add up the four probabilities - is the result you would expect?

Look at the numbers on the two branches for each outcome. How might you combine these to give the required probability?

Does your rule work for all four outcomes?

Can you explain your rule?

Extension questions

You should answer these questions from the tree diagram/2-way table showing expected results (p3). Give answers to probability questions as fractions of the appropriate whole number.

12. How many athletes test positive? ....

13. What is the probability that an athlete who tests positive is taking the banned substance? ....

14. How many athletes are taking the banned substance? ....

15. What is the probability that an athlete who is taking the banned substance tests negative? ....

16. How many athletes are not taking the banned substance? ....

17. What is the probability that an athlete who is not taking the banned substance tests positive? ....

18. Why are these two probabilities not the same? ....

   a) an athlete who is taking the banned substance tests negative ....

   b) an athlete who tests negative is taking the banned substance. ....

http://nrich.maths.org/9840