

## STEP II, 2008, Q12

- 12 In the High Court of Farnia, the outcome of each case is determined by three judges: the ass, the beaver and the centaur. Each judge decides its verdict independently. Being simple creatures, they make their decisions entirely at random. Past verdicts show that the ass gives a guilty verdict with probability  $p$ , the beaver gives a guilty verdict with probability  $p/3$  and the centaur gives a guilty verdict with probability  $p^2$ .

Let  $X$  be the number of guilty verdicts given by the three judges in a case. Given that  $E(X) = 4/3$ , find the value of  $p$ .

The probability that a defendant brought to trial is guilty is  $t$ . The King pronounces that the defendant is guilty if at least two of the judges give a guilty verdict; otherwise, he pronounces the defendant not guilty. Find the value of  $t$  such that the probability that the King pronounces correctly is  $1/2$ .



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