4 A fair tetrahedral die has faces numbered 1, 2, 3, 4. A coin is biased so that the probability of showing a head when thrown is $\frac{1}{3}$. The die is thrown once and the number n that it lands on is noted. The biased coin is then thrown n times. So, for example, if the die lands on 3, the coin is thrown 3 times.

(i) Find the probability that the die lands on 4 and the number of times the coin shows heads is 2. [3]

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(ii) Find the probability that the die lands on 3 and the number of times the coin shows heads is 3. [1]

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(iii) Find the probability that the number the die lands on is the same as the number of times the coin shows heads. [3]

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