1. The sample space of this algorithm is all possible permutations of the list l. The probabilities of this sample space only vary with the position of n because the orders of all the other elements are equally likely.

   Prob[n is in i^{th} position] $= \frac{1}{2}^i$

2. Prob[l is not in $i_1 \ldots i_m$] $= \begin{cases} \frac{1}{2}^m & l = n \\ (1 - \frac{1}{2n})^m & l \neq n \end{cases}$

   If n does not appear in i then that is the probability of not choosing n, m times. Similarly the probability of l not appearing in i is $1-$ the probability of choosing l, m times.

3. $P_l = \frac{1}{2} + \frac{1}{2}(1 - \frac{1}{2n})\frac{1}{2}(1 - \frac{1}{2n})^2 + \cdots + \frac{1}{2}(1 - \frac{1}{2n})^{m-1}$

   $= \frac{1}{2}\sum_{i=1}^{m} \frac{1}{2}(1 - \frac{1}{2n})^{i-1} = n(1 - (1 - \frac{1}{2n})^m)$

   The sum comes from the chance of n being picked at each i over our element not being picked. So it is the probabilty that n was picked multiplied by the probability l was not picked before hand summed over each possible position of n.

4. $E[B_l] = 1\cdot$ prob[l is before n] $+0\cdot$ prob[n is before l] $= 1 - P_l = 1 - n(1 - (1 - \frac{1}{2n})^m)$

5. $E[T] = \sum_{l=0}^{n-1} E[B_l]$

   $= n(1 - n(1 - (1 - \frac{1}{2n})^m)) = n - n^2 + n^2(1 - \frac{1}{2n})^m$