Suppose we have an i.i.d. sample and a superconservative online algorithm that makes at most T mistakes. What is the maximum expected error of the mth sample?

If $m < T$ then 1

Otherwise there are T error rates $e_1, ..., e_T$ (and a implicit distribution over these error rates). The probabability of making a mistake on the m'th sample is

$\max_{e_1,\ldots,e_T} e_1[(1-e_1)^{m-1} + e_2 \sum_{i_1=0}^{m-2} (1-e_1)^{i_i}[(1-e_2)^{m-i_1-2} + e_3 \sum_{i_2=0}^{m-i_1-3}[(1-e_2)^{i_3} + ...]]]$