M1S TUTORIAL SHEET : WEEK 6

Solve the following problems using a direct approach, that is, by listing and counting sample outcomes, and then try to use more formal combinatorial or conditional probability approaches.

1. n digits are selected with replacement from $\{0, 1, ..., 9\}$. Evaluate the probability that r distinct digits are selected, for $1 \leq r \leq n$, and for $n = 3, 4$. Can you find a general formula ?

2. There are two alternate forms for the probability that results from a hypergeometric sampling experiment; if a finite population of size N comprises R Type I objects and $N - R$ Type II objects, and a sample of size $n \leq N$ is obtained from the population, then the probability that the sample contains r Type I objects and $n - r$ Type II objects is either expressed

$$\frac{\binom{n}{r}\binom{N-n}{R-r}}{\binom{N}{R}}$$

or

$$\frac{\binom{R}{r}\binom{N-R}{n-r}}{\binom{N}{n}}$$

and the equality of these two expressions is easy to verify using the factorial definitions. Try to explain each term directly using combinatorial arguments.