

VE401 Assignment

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Exercise 1. Elementary Probability

Solution. We use Cardano's principle to get the probability. The number of ways to pick 120 people from 2000 individuals is

$$n_1 = \frac{2000!}{120! \times (2000 - 120)!}$$

The number of ways that me and my friend are both chosen is equal to the number of ways to choose 118 people from 1998 individuals, which is

$$n_2 = \frac{1998!}{118! \times (1998 - 118)!}$$

Therefore the probability that me and my friend will both be chosen is

$$\frac{n_2}{n_1} = \frac{\frac{1998!}{118! \times (1998 - 118)!}}{\frac{2000!}{120! \times (2000 - 120)!}} = 0.357\%$$

□

Exercise 2. Some Routine Calculations

- i) **Proof.** Since $A \subset B$, $B = A + B \setminus A$. Note that $A \cap B \setminus A = \emptyset$. Thus $P[B] = P[A] + P[B \setminus A] \geq P[A]$. Therefore $P[A] \leq P[B]$. □
- ii) **Proof.** Since A and B are independent, we have $P[A \cap B] = P[A]P[B]$. We know that $P[A]P[B] > 0$ so $P[A \cap B] > 0$. Thus $P[A \cap B] = \frac{|A \cap B|}{|S|} > 0$, which means that $|A \cap B| > 0$. Therefore, $A \cap B \neq \emptyset$ and hence they are not mutually exclusive. □
- iii) **Proof.** □