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 $A \subset B$, $|A| \leq |B|$. If $P[B] = 0$ then $P[A] = P[B] = 0$. Now suppose that $P[B] \neq 0$. Since$P[A]/P[B] = |A|/|B|$, we have $P[A]/P[B] \leq 1$ hence $P[A] \leq P[B]$. □

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.** □