

## Class Exercise

### 1. **Agentic swarm**

Masterbot manages 22 AI agents residing in my laptop.

- (a) In how many ways could the agents be assigned into four group projects requiring 9,5,4 and 4 agents respectively. Each agent is assigned to precisely one team.
- (b) In how many ways could the very same assignment be done if two of the AI agents absolutely refuse to be on the same team?

### 2. **Poker hand**

Two Pairs is a poker hand in which two of the cards are of the same rank, another two cards are also of the same rank, which however is different from the rank of the first pair and the fifth card is of a rank different from the ranks of the two pairs. Here is an example:  $5\heartsuit, 5\spadesuit, Q\clubsuit, Q\spadesuit, 10\diamondsuit$ . What is the probability that a randomly selected poker hand is Two Pairs?

### 3. **Koala thieves**

In 2006, thieves planning to steal a koala from a zoo in Australia, had to change their minds after it proved too vicious to be abducted. The perps, later confessed that their original plan was to swap the koala for drugs; but after it scratched hell out of them, they opted to steal a 1.4 metre crocodile instead - which they claimed was a lot easier<sup>1</sup>.

- (a) A witness reported that a car seen speeding away from the zoo had a number plate that began with a V or W, the digits 4,7, and 8, and the end letters A,C, and E. However, they could not remember the order of the digits or the end letters. How many cars would need to be checked to be sure of including the suspect car?
- (b) In other parts of Australia, a licence plate consists of a sequence of seven symbols: number, letter, letter, letter, number, number, number, where a letter is any one of 26 letters (A - Z) and a number is one of (0 - 9). Assume that all licence plates are equally likely.
  - i. What is the probability that all symbols are different?
  - ii. What is the probability that all symbols are different and the first number is the largest among the numbers?

---

<sup>1</sup><https://www.smh.com.au/national/cranky-koala-meaner-than-stolen-croc-20060330-gdn9jt.html>

**4. Scandinavians**

A group of 18 Scandinavians consists of 5 Norwegians, 6 Swedes, and 7 Finns. They are seated at random in a row of chairs. Compute the following probabilities:

- (a) that all the Norwegians sit together,
- (b) that all the Norwegians and all the Swedes sit together
- (c) that all the Norwegians, all the Swedes, and all the Finns sit together.

**5. Sampling a Chemical Process**

Hourly samples of a chemical process are collected for 24 samples per day, but due to the cost considerations only 5 samples are actually analysed each day. Assume the decision on which 5 samples are to be analysed is made at random.

- a) In how many ways can the 5 analysed samples be distributed through the day if the the 5 analyses done are all different?
- b) In how many ways can the 5 analysed samples be distributed through the day if the 5 analyses done are identical?
- c) What is the probability that all 5 analysed samples would be from the samples collected before noon if the analyses done are all different?
- d) What is the probability that all 5 analysed samples would be from the samples collected before noon if the analyses done are identical?