**STATICS ASSIGNMENT\_3**

**1.For a group of 7 people, find the probability that all 4 seasons (winter, spring, summer, fall) occur at least once each among their birthdays, assuming that all seasons are equally likely.**

To find the probability that all 4 seasons occur at least once each among the birthdays of 7 people, we can use the Principle of Inclusion-Exclusion. This principle states that the number of successful outcomes in the union of two or more events can be found by adding the number of successful outcomes in each event and then subtracting the number of successful outcomes in their intersection.

The number of successful outcomes (birthdays that correspond to each season) can be calculated as follows:

P(winter) = 7C1/4^1

P(spring) = 7C1/4^1

P(summer) = 7C1/4^1

P(fall) = 7C1/4^1

The number of successful outcomes in the intersection of two seasons (for example, both winter and spring) can be calculated as follows:

P(winter and spring) = 7C2/4^2

Similarly, the number of successful outcomes in the intersection of all 4 seasons can be calculated as follows:

P(winter and spring and summer and fall) = 7C4/4^4

Now, using the Principle of Inclusion-Exclusion, the probability of all 4 seasons occurring at least once each can be calculated as follows:

P = P(winter) + P(spring) + P(summer) + P(fall) - P(winter and spring) - P(winter and summer) - P(winter and fall) - P(spring and summer) - P(spring and fall) - P(summer and fall) + P(winter and spring and summer and fall)

Plugging in the values calculated above, we get:

P = 7C1/4^1 + 7C1/4^1 + 7C1/4^1 + 7C1/4^1 - 7C2/4^2 - 7C2/4^2 - 7C2/4^2 - 7C2/4^2 - 7C2/4^2 - 7C2/4^2 + 7C4/4^4

This is the final answer for the probability that all 4 seasons occur at least once each among the birthdays of 7 people.

**2. Alice attends a small college in which each class meets only once a week. She is deciding between 30 non-overlapping classes. There are 6 classes to choose from for each day of the week, Monday through Friday. Trusting in the benevolence of randomness, Alice decides to register for 7 randomly selected classes out of the 30, with all choices equally likely. What is the probability that she will have classes every day, Monday through Friday?**

To find the probability that Alice has classes every day from Monday to Friday, we can use the Principle of Inclusion-Exclusion. This principle states that the number of successful outcomes in the union of two or more events can be found by adding the number of successful outcomes in each event and then subtracting the number of successful outcomes in their intersection.

The number of successful outcomes (having a class on Monday) can be calculated as follows:

P(Monday) = 30C1/30C7

Similarly, the number of successful outcomes for having a class on each day of the week can be calculated as follows:

P(Tuesday) = 29C1/30C7

P(Wednesday) = 28C1/30C7

P(Thursday) = 27C1/30C7

P(Friday) = 26C1/30C7

The number of successful outcomes in the intersection of two days (for example, having a class both on Monday and Tuesday) can be calculated as follows:

P(Monday and Tuesday) = 29C2/30C7

Similarly, the number of successful outcomes in the intersection of all 5 days can be calculated as follows:

P(Monday and Tuesday and Wednesday and Thursday and Friday) = 26C5/30C7

Now, using the Principle of Inclusion-Exclusion, the probability of having a class every day from Monday to Friday can be calculated as follows:

P = P(Monday) \* P(Tuesday) \* P(Wednesday) \* P(Thursday) \* P(Friday) - P(Monday and Tuesday) \* P(Wednesday and Thursday and Friday) - P(Tuesday and Wednesday) \* P(Thursday and Friday and Monday) - P(Wednesday and Thursday) \* P(Friday and Monday and Tuesday) - P(Thursday and Friday) \* P(Monday and Tuesday and Wednesday) + P(Monday and Tuesday and Wednesday and Thursday and Friday)

Plugging in the values calculated above, we get:

P = 30C1/30C7 \* 29C1/30C7 \* 28C1/30C7 \* 27C1/30C7 \* 26C1/30C7 - 29C2/30C7 \* 26C5/30C7 - 28C2/30C7 \* 27C5/30C7 - 27C2/30C7 \* 28C5/30C7 - 26C2/30C7 \* 29C5/30C7 + 26C5/30C7

This is the final answer for the probability that Alice has classes every day from Monday to Friday.