Theoretical Probability

Situation #2:

Mr. Chow places five cards with names written on them in a bucket. The five names are Auli'i, Chasen, Ho'onani, Jesse, and Kalama. Every day for 10 days, Mr. Chow will choose two names from the bucket. As a prize, the two students who are drawn will get to eat a McDonald's lunch in the staff dining room. Of course, Mr. Chow will put the names he chose back in the bucket every day. Auli'i and Ho'onani really want their names to be drawn on the same day so that they can eat lunch together. They wonder about the chances that this will happen.

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Situation #2 is an example of a **compound event** because all of the outcomes result from more than one action. In Situation #2, Mr. Chow is drawing two cards. Since Auli'i and Ho'onani want to eat together, the **favorable outcome** for drawing two cards is "Auli'i and Ho'onani" because this is the outcome we are interested in. Since the outcomes result from more than one action, finding the **sample space** (the list of all the possible outcomes) of this compound event becomes more difficult. It becomes very important that we find the sample space in an organized way.

In the Situation #2, if we wanted to find the *experimental* probability that Auli'i and Ho'onani's names would both be drawn, we would have to conduct an experiment. We could get five index cards and write the names Auli'i, Chasen, Ho'onani, Jesse, and Kalama on each card. Then, we could place the cards in a bag and draw two cards at a time. Each time we drew two cards, we would record the two names and return the cards to the bag.

Think About This! What are all of the different outcomes that we could get if we drew two names out of the bag?

If we did this experiment 25 times and got the outcome, "Auli'i and Ho'onani," 4 times, we would say that the experimental probability is $P(\text{Auli'i and Ho'onani}) = \dfrac{\text{the number of times a favorable outcome occurs}}{\text{the total number of experiments}} = \dfrac{4}{25}$.

In order to find the **theoretical probability** of an event occurring, we cannot do an experiment. We need to find the sample space. Once we find the sample space, we can count the number of favorable outcomes and the total number of possible outcomes and use the following formula for the theoretical probability:

$$P(\text{favorable outcome}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

In order to find the number of favorable outcomes and the number of possible outcomes, we need to find the sample space. Then, we can count the number of favorable outcomes and the number of possible outcomes and put those numbers in the formula for theoretical probability.

QAR: Literal

1. Define **favorable outcome** and **compound event.**

favorable outcome: the outcome we are interested in

compound event: all of the outcomes result from more than one action

QAR: Literal

2. What are the names on the cards that Mr. Chow placed in the bucket?

Auli'i (A), Chasen (C), Ho'onani (H), Jesse (J), Kalama (K)

QAR: Literal

3. Define **sample space.**

sample space: the list of all possible outcomes

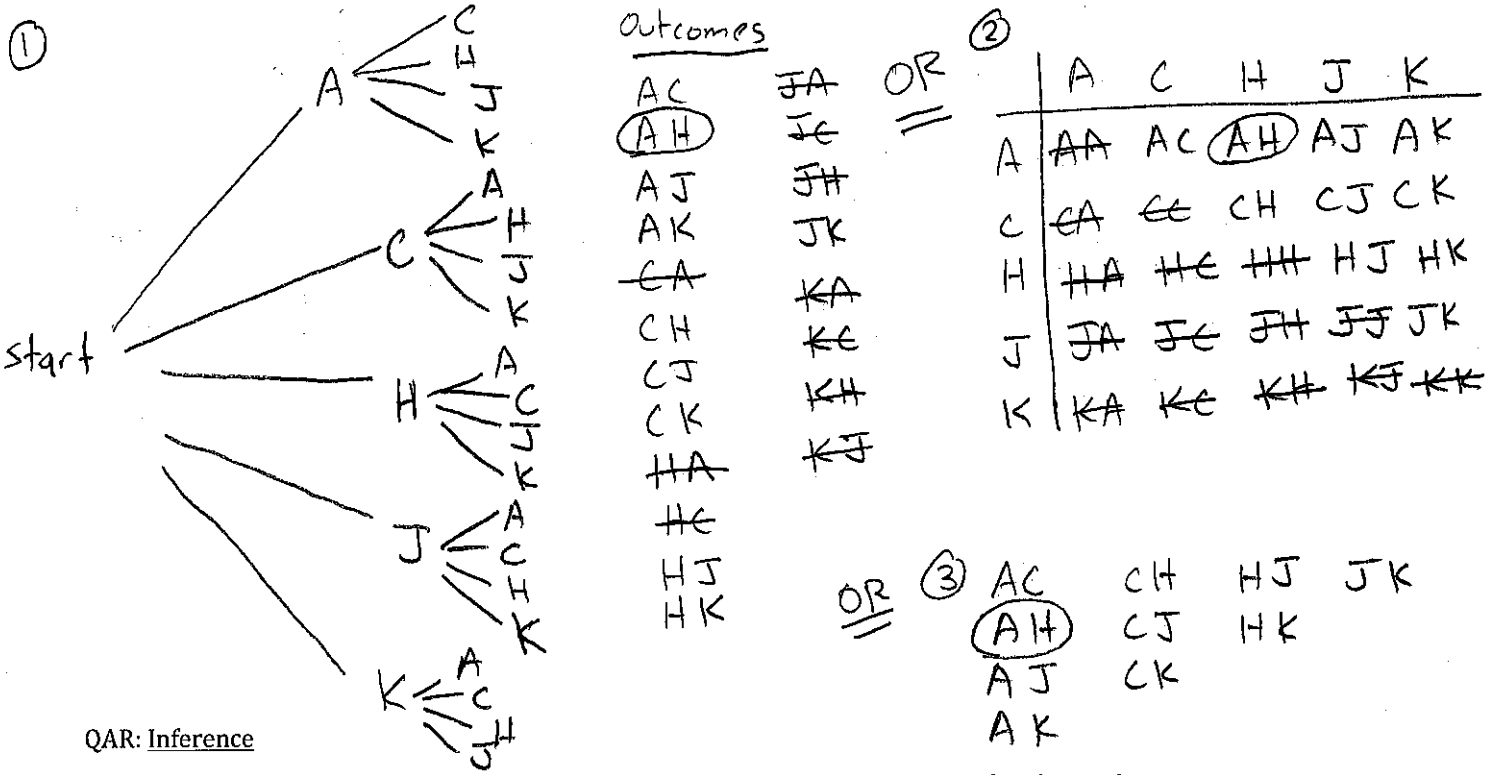
QAR: Literal

4. Write the formula for **theoretical probability.**

$$P(\text{favorable outcome}) = \frac{\text{number of favorable outcomes}}{\text{number of possible outcomes}}$$

QAR: Inference

5. In an organized way, find the sample space for reaching into the bucket and choosing two names.



QAR: Inference

6. Find the **theoretical probability** that Auli'i and Ho'onani will get to eat lunch together.

$$P(AH) = \boxed{\frac{1}{10}}$$