Designing Simulations

1. A child is playing a game where they pick a card that is either a unicorn or dragon. In the last 5 turns, they got 4 unicorns and 1 dragon. The probability that a card will be a unicorn is $\frac{1}{2}$.

   - What is the probability that a person gets exactly 4 unicorns in 5 turns?
   - Is this case unusual? Explain your reasoning.

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2. Three smoke detectors are installed in a factory room to make sure that if there is a fire, at least one of them will signal a warning. The probability that any one of the smoke detectors will work correctly is 0.75. This also means that there is a 25% chance that if there is smoke or a fire, the detector will not work!

   - What is the probability that if there is smoke in the factory, none of the 3 detectors would work?
   - Does this probability indicate a safety problem for the factory? Explain your reasoning.

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3. Several new cars from a certain factory are shipped out with a brake problem. It is estimated that approximately 10% of the cars assembled at this factory have defective brakes. Five of these cars are shipped to a dealership.

   - What is the probability that none of the 5 cars have defective brakes?
   - Should the dealership be concerned? Explain your reasoning.

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4. At a summer camp, your group is working with park rangers for the next 5 days. The rangers at the camp indicate that there is a 40% chance of seeing an eagle each day.

   - What is the probability that you will see an eagle on two or more of the 5 days?
   - Your camp leader also indicates that if you see eagles 2 or more times during the 5 days, your group will win a prize. Do you think you have a good chance of winning a prize? Explain your reasoning.

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5. At a small animal hospital, there is a 20% chance that an animal may need to stay overnight. The hospital only has enough room to hold 2 animals per night. On a particular day, 5 animals are brought into the hospital.

   - What is the probability that at least 3 of the animals may need to stay overnight?
   - If seeing 5 animals per day is typical for this hospital, do you think the hospital is usually able to accommodate all of the animals that might have to stay overnight? Explain your reasoning.

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