Problem 1 Two cards are drawn, without replacement, from a standard, well-shuffled deck of cards. Let A be the event that the first card is a heart, and B be the event that the second card is red. Compute the following probabilities.

(a) $P(A \cap B)$

(b) $P(A \mid B)$

(c) $P(B \mid A)$

Problem 2 Consider a coin biased to show Heads with probability $\frac{3}{4}$, and suppose we flip the coin n times. What is the probability that we get exactly k Heads, for $0 \leq k \leq n$?

Problem 3 You're testing out a machine learning classifier that is designed to identify whether an image contains a cat. The classifier correctly identifies 90% of cat images as containing cats. However, it also incorrectly labels 15% of non-cat images as containing cats. You run it on a dataset where 10% of images actually contain cats. What is the probability that an image labeled as a cat actually contains a cat?