1. The sample space of a fair coin flip is $\{H, T\}$.

   The sample space of a sequence of three fair coin flips is all 2^3 possible sequences of outcomes: $\{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}$.

   The sample space of a sequence of five fair coin flips in which at least four flips are heads is $\{HHHHH, HHHHT, HHHTH, HHTHH, HTHHH, THHHH\}$.

   The probability of heads doesn't matter (unless it's 0 or 1).

2. $P(\text{sum is } 8) = P(2,6) + P(6,2) + P(3,5) + P(5,3) + P(4,4) = \frac{5}{36}$

   $P(\text{sum is } 8|\text{first is } 3) = P(5) = \frac{1}{6}$

3. $P(\text{disease}|\text{positive}) = \frac{P(\text{positive}|\text{disease})P(\text{disease})}{P(\text{positive})}$

   $= \frac{P(\text{positive}|\text{disease})P(\text{disease})}{P(\text{positive}|\text{disease})P(\text{disease}) + P(\text{positive}|\text{no disease})P(\text{no disease}))}$

   $= \frac{0.95 \times 0.001}{(0.95 \times 0.001) + (0.05 \times 0.999)} \approx 0.0187$

4. $P(\neg T, \neg C) = 1 - (0.05 + 0.05 + 0.1) = 0.8$

   $P(T) = 0.05 + 0.05 = 0.1$

   $P(C) = 0.05 + 0.1 = 0.15$

   They are not independent.

   $P(T|C) = \frac{0.05}{0.05 + 0.1} = \frac{1}{3} \neq 0.1 = P(T)$.

5. $P(A \cap B) = P(\text{first roll is 3})) = \frac{1}{6}$

   $P(A \cap C) = P(\text{first roll is 3 and second roll is a 6})) = \frac{1}{36}$

   $P(B \cap C) = P(\text{rolls are (3,6), (4,5), or (5,4)})) = \frac{3}{36} = \frac{1}{12}$

   $P(A \cap B \cap C) = P(\text{first roll is 3 and second roll is a 6})) = \frac{1}{36}$

6. $P(\text{biased}|\text{all 10 heads}) = \frac{P(\text{all 10 heads}|\text{biased})P(\text{biased})}{P(\text{all 10 heads})}$

   $= \frac{P(\text{all 10 heads}|\text{biased})P(\text{biased})}{P(\text{all 10 heads}|\text{biased})P(\text{biased}) + P(\text{all 10 heads}|\text{fair})P(\text{fair})}$

   $= \frac{1 \times 0.001}{(1 \times 0.001) + (0.5^{10} \times 0.999)} \approx 0.506$