Q1) Bayesian Reasoning

Given data

$A \rightarrow 51 \rightarrow P(A_K) = 0.51$ (K = question number)

$B \rightarrow 49 \rightarrow P(B_K) = 0.49$

Let $P(A_T) = P(A_1 \cap A_2 \cap A_3 \cap A_4 \cap A_5 \cap A_6 \cap A_7 \cap A_8)$

What is $P(B_9 | A_T)$?

$$P(B_9 | A_T) = \frac{P(A_T | B_9)\, P(B_9)}{P(A_T)} \overset{\text{(independent)}}{=} \frac{P(B_9 \cap A_T)}{P(A_T)}$$

B_9, A_T independent so $P(B_9 \cap A_T) = P(B_9) \cdot P(A_T)$

$$P(B_9 | A_T) = \frac{P(B_9) \cdot P(A_T)}{P(A_T)} = P(B_9)$$

$$\boxed{P(B_9 | A_T) = 0.49}$$