

In a recent senatorial election, 50% of the voters in a certain district were registered as Democrats, 35% were registered as Republicans, and 15% were registered as Independents. The incumbent Democratic senator was reelected over her Republican and Independent opponents. Exit polls indicated that she had 75% of the Democratic vote, 25% of the Republican vote, and 30% of the Independent vote. Assuming that the exit poll is accurate, what is the probability that a vote for the incumbent was cast by a registered Republican?

D s Democrat
I s Independent
R s Republican
V voted for incumbent

$$\begin{aligned} P(R|V) &= \frac{P(V|R)P(R)}{P(V|R)P(R) + P(V|D)P(D) + P(V|I)P(I)} \\ &= \frac{.25 * .35}{.25 * .35 + .75 * .50 + .30 * .15} \\ &\approx 0.1724 \end{aligned}$$