Probability Assignment

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Of the students in a college, it is known that 60% reside in hostel and 40% are day scholars (not residing in hostel). Previous year results report that 30% of all students who reside in hostel attain A grade and 20% of day scholars attain A grade in their annual examination. At the end of the year, one student is chosen at random from the college and he has an A grade, what is the probability that the student is a hostlier?

Solution

Using Baye's Rule:
Let the probability of students living in hostel be P(H=1), therefore the students who are day scholars can be given as P(H=0)
The probability of the students getting grade A is given as P(A=1).
By given information,

$$P(H=1)=\frac{60}{100} \tag{1}$$

$$P(H=0)=\frac{40}{100} \tag{2}$$

$$P(A=1|H=1)=\frac{30}{100} \tag{3}$$

$$P(A=1|H=0)=\frac{20}{100} \tag{4}$$

Thus,

$$P(A=1)=\sum_{i=0}^{1}P(A=1|H=i)P(H=i) \tag{5}$$

$$\begin{aligned}\text{P(A=1)} = {} & P(A=1|H=0)P(H=0)+\\ & P(A=1|H=1)P(H=1)\end{aligned}$$

$$P(A=1)=\left(\frac{20}{100}\times\frac{40}{100}\right)+\left(\frac{30}{100}\times\frac{60}{100}\right) \tag{6}$$

$$P(A=1)=\frac{26}{100} \tag{7}$$

$$P(H=1|A=1)=\frac{P(A=1|H=1)P(H=1)}{P(A=0)} \tag{8}$$

$$P(H=1|A=1)=\frac{9}{13} \tag{9}$$

The probability that the student is a hostlier who has A grade is $\frac{9}{13}$.