1 Lesson 8 Example 2

Anny is a fan of chess competitor Hikaru Nakamura, and tomorrow is the World Chess Championship. She is superstitious and believes that the weather influences how he will perform. Hikaru has a 60% chance of winning if it rains, a 25% chance if it is cloudy, and a 10% chance if it is sunny. Anny checks the weather the night before, and the forecast says that the chance of rain tomorrow is 40%; otherwise, it is equally likely to be cloudy as sunny. What is the probability that Hikaru wins the World Chess Championship?

2 Answer

- **Probability that Hikaru wins if it rains:** $P(W \mid R) = 0.60$
- **Probability that Hikaru wins if it is cloudy:** $P(W \mid C) = 0.25$
- **Probability that Hikaru wins if it is sunny:** $P(W \mid S) = 0.10$
- **Probability of rain:** $P(R) = 0.40$
- **Probability of cloudy:** $P(C) = 0.30$ (since it is equally likely to be cloudy or sunny, and the remaining 60% must be split evenly)
- **Probability of sunny:** $P(S) = 0.30$

2.1 Using the Law of Total Probability

The overall probability that Hikaru wins the championship, $P(W)$, is given by:

$$P(W) = P(W \mid R) \cdot P(R) + P(W \mid C) \cdot P(C) + P(W \mid S) \cdot P(S)$$

2.2 Substituting the Known Values

$$P(W) = (0.60 \times 0.40) + (0.25 \times 0.30) + (0.10 \times 0.30)$$

$$P(W) = 0.24 + 0.075 + 0.03$$

$$P(W) = 0.345$$

Conclusion

The probability that Hikaru Nakamura wins the World Chess Championship is **0.345**, or **34.5%**.