CS2402 - Tutorial 7

Task 1. Suppose P(rain today)=40%, P(rain tomorrow)=50%, P(rain today and tomorrow)=30%. Given that it rains today what is the chance that it will rain tomorrow.

$P(\text{tomorrow}|\text{today}) = \frac{0.3}{0.4} = 0.75$

Task 2. Assume that identical twins are always of the same sex, equally likely boys or girls. Assume for non-identical twins the firstborn is equally likely to be a boy or a girl, and so is the secondborn, independently of the first, Assume that 45% of twins are identical, 55% are non-identical. Find the following probabilities:

1. Probability of both boys.
2. Probability that the firstborn is a boy and the second is a girl.
3. P(secondborn is a girl|firstborn is a boy)
4. P(secondborn is a girl|firstborn is a girl)

Hint: A=Identical twin(45%) : {girl, girl} , {boy, boy}
B=Non-identical twin(55%): {girl, girl}, {girl, boy}, {boy, girl}, {boy, boy}

Task 3. Give a formula for $P(F|\bar{G})$ *in terms of* P(F), P(G) and P(FG) only.

$P(F|\bar{G}) = \frac{P(F\bar{G})}{P(\bar{G})} = \frac{P(F) - P(FG)}{1-P(G)}$

Task 4. Let E and H be two events, prove:

$$P(E) = P(E|H)P(H) + P(E|\neg H)P(\neg H).$$

where $\neg H = \bar{H}$. (This result will be used in Lecture 10).

Task 5. Prove If B_1, B_2, B_3 are mutually exclusive, and $B_1 \cup B_2 \cup B_3$ be the outcome space S. Then for any event A:

$$P(A) = P(A|B_1)P(B_1) + P(A|B_2)P(B_2) + P(A|B_3)P(B_3)$$

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