

1. **Joint and conditional probabilities:** $\Pr(A) = 0.3, \Pr(B) = 0.7$

a. Can you compute $\Pr(A \cap B)$ if you only know $\Pr(A)$ and $\Pr(B)$?

b. Assuming that events A and B arise from independent random processes,

i. what is $\Pr(A \cap B)$?

ii. what is $\Pr(A \cup B)$?

iii. what is $\Pr(A|B)$?

c. If we are given that $\Pr(A \cap B) = 0.1$,

i. are the random variables giving rise to events A and B independent?

ii. what is $\Pr(A|B)$?

2. **Global warming:** A 2010 Pew Research poll asked 1,306 Americans “From what you’ve read and heard, is there solid evidence that the average temperature on earth has been getting warmer over the past few decades, or not?” The table below shows the distribution of responses by party and ideology, and the counts have been replaced with a relative frequencies.

Party or Ideology	Dont Know	Refuse to Answer	Earth is Warming	Not Warming	Total
Conservative Republican		0.02	0.11	0.20	0.33
Liberal Democrat		0.01	0.18	0.01	0.20
Mod/Cons Democrat		0.02	0.25	0.07	0.34
Mod/Lib Republican		0.01	0.06	0.06	0.13
Total		0.06	0.60	0.34	1.00

- a. What is the probability that a randomly chosen respondent believes the earth is warming or is a liberal Democrat?

- b. What is the probability that a randomly chosen respondent believes the earth is warming given that he is a liberal Democrat?

- c. What is the probability that a randomly chosen respondent believes the earth is warming given that he is a conservative Republican?

- d. Does it appear that whether or not a respondent believes the earth is warming is independent of their party and ideology? Explain your reasoning.

- e. What is the probability that a randomly chosen respondent is a moderate/liberal Republican given that he does not believe that the earth is warming?

3. **It's never lupus:** Lupus is a medical phenomenon where antibodies that are supposed to attack foreign cells to prevent infections instead see plasma proteins as foreign bodies, leading to a high risk of blood clotting. It is believed that 2% of the population suffer from this disease.

The test is 98% accurate if a person actually has the disease. The test is 74% accurate if a person does not have the disease.

There is a line from the Fox television show *House*, often used after a patient tests positive for lupus: "It's never lupus." Do you think there is truth to this statement? Use appropriate probabilities to support your answer.