

STAT 509 2017 Summer HW2

Instructor: Shiwen Shen

Lecture Day: May 9

- A and B are two events in the sample space S . Assume $P(A) = 0.25$, $P(B) = 0.4$, and $P(A \cup B) = 0.6$. Calculate the following probabilities. Clearly state what probability rules you are using. (Hint: You can draw Venn Diagrams to help you visualize the relationship among two events and the sample space.)

 - $P(\bar{A})$
 - $P(A \cap B)$
 - $P(A \cap \bar{B})$
 - $P(\bar{A} \cup \bar{B})$
 - $P(B|A)$
 - Are A and B independent? Why or why not?
- Transactions to a computer database are either new items or changes to previous items. The addition of an item can be completed in less than 100 milliseconds 90% of the time, but only 20% of changes to a previous item can be completed in less than this time. If 30% of transactions are changes, what is the probability that a transaction can be completed in less than 100 milliseconds?
- The probability that a randomly chosen automobile will need an oil change is 0.25; the probability that it needs a new oil filter is 0.40; and the probability that both the oil and filter need changing is 0.14.

 - What is the probability that a car will need an oil change or new filter?
 - If the oil had to be changed, what is the probability that a new oil filter is needed?
 - If a new oil filter is needed, what is the probability that the oil has to be changed?
 - Are oil filter and needing an oil change independent of one another. Why?
- The use of plant appearance in prospecting for one deposits is called geobotanical prospecting. One indicator of copper is a small mint with a mauve-colored flower. Suppose that, for a certain region, there is a 30 percent chance that the soil has a high copper content and a 23 percent chance that the mint will be present there. In addition, we know that if the copper content is high, there is a 70 percent chance that the mint will be present. Let A denote the event that a soil sample has high copper content, and let B denote the event that the mint is present.

 - Find the probability that the copper content is not high.
 - Find the probability that the copper content will be high and the mint will be present.
 - Find the probability that the copper content will be high given that the mint is present.
 - Are the events A and B independent? Why?
- DeMorgan's Law states: if A and B are two events in the same sample space, then

$$\overline{A \cup B} = \bar{A} \cap \bar{B},$$

and

$$\overline{A \cap B} = \overline{A} \cup \overline{B}.$$

We have discussed the proof of the first equation in class, try to prove the second one using the similar type of argument.