

Math 342 — Set properties

Problem 1. Let A, B, C be events. Draw Venn diagrams for the following events and make note of the formulas that you seem to be deriving.

- $(A \cup B)^c$
- $A^c B^c$
- $(AB)^c$
- $A^c \cup B^c$
- $A(B \cup C)$
- $AB \cup AC$

Note for after class or if you finish the rest of the problems early. The formulas you derived show that set operations have *distributive* properties. You've derived three formulas but there's a fourth. What is it? Put all four in your notes!

Problem 2. Suppose A and B are two given events. For each of the following new events, draw a Venn diagram and then express it in terms of A and B using intersection, union, complement, or some combination of these operations.

- At least one of the two events occurs,
- Both of the events occur,
- Neither event occurs,
- Exactly one of the two events occur.
- At most one of the two events occurs.

Problem 3. Consider the events A and B from the previous problem and suppose that $P(A) = 0.4$, $P(B) = 0.5$, and $P(A \cup B) = 0.8$. Find the probabilities of each of the five new events of the previous problem.

Problem 4. Suppose $P(A \cup B) = 0.6$ and $P(A \cup B^c) = 0.8$. Find $P(A)$.

Problem 5. Zahkeyah is taking two books along on her holiday vacation. With probability 0.5, she will like the first book; with probability 0.4, she will like the second book; and with probability 0.3, she will like both books. Find the probability that she likes neither book. *Make sure to clearly define some notation using sentences and then show your steps.*

Problem 6. The probability that a visit to a Primary Care Physician (PCP)'s office results in neither lab work nor a referral to a specialist is 35%. On the other hand, 30% of PCP visits are referred to a specialist and 40% require lab work. Find the probability that a PCP visit results in both lab work and a referral to a specialist. *Make sure to clearly define some notation using sentences and then show your steps.*