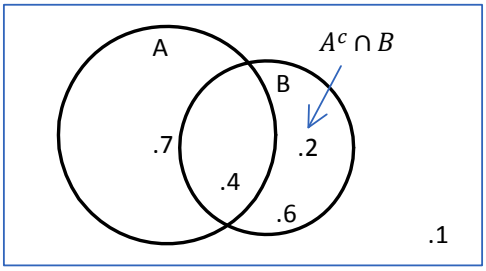
Problem Set 2

Wednesday, August 30, 2017
3:45 PM

Homework
Problem Set 2
Trosset chapter 3.7 exercise 7

1. (a)



(b) No. $P(A) + P(B)$ = .7 + .6 = 1.3, which is greater than 1, which is impossible. Thus there must be some overlap. The definition of pairwise disjoint is that for any pair of events, the probability that they both happen is zero. Here the probability that they both happen is ($P(A \cup B^{\square})$ *or* .4

(c) What is the probability of $A \cup B^C$?

$P(A \cup B^C) = P(A) + P(A^C \cup B^C) = .7 + .1 = .8$

2. A statistics class contains 35 students: 11 undergrads and 24 grad students. Of the undergraduates, 4 are female and 7 and male. Of the grad students, 5 are female and 19 are male.
   (a) I randomly select a student from the class. Given that the student I select is a male, what is the conditional probability that they are an undergraduate?
   - **There are 7 male undergrads and 19 male grads for a total 26 males. Therefore, the conditional probability of selecting an undergraduate (A) given that the student is male (B) is P(A | B) = 7/26.**

   (b) I randomly select two students from the class, without replacement, in order. Given that the first student I select is a grad student, what is the conditional probability the second student I select is an undergraduate?
   - **There are 11 undergrads and 24 grad students. The probability of selecting a grad student on the first choice is 24/35. The probability of selecting an undergrad on the second choice (without replacement) is 11/34.**

3. Chapter 3.7 exercise 12, parts e to g.
   a. S = Hollywood movies. A = color, B = Western. These two events are independent. The probability that a movie is a Western (B) is not dependent on whether it is in color. Additionally, many Westerns were made before color movies, indicating that the order of events is not important.
   e. S = US College Freshmen. A = William and Mary, B = High school in VA. Here, the events are dependent. First, the order of events matters most, as a person must graduate high school before attending college. Further, P(A) depends on the outcome of B.
   f. S = All persons who have earned a PhD. A = pre-1950, B = female. This two events are dependent. Whether a person who earned a PhD before 1950 was a female depends on the

rate of female PhD candidates.

4. CDF questions.
   a. $P(X \leq 1) = P(X < 1) + P(X = 1)$.
      i. $P(X < 1) = \frac{y+2}{4}$
         1) $(y+2)/4 = \frac{1+2}{4} = .75$
         2) $P(X < 1) = .75$
         3) **.75 + 0 = 0.75**
   b. $P(X > 1) = 1 - P(X \leq 1) + P(X = 1)$
      i. $P(X \leq 1) = \frac{y+2}{4} + 0 = .75$
      ii. $.75 + P(X = 1) = .75.\ P(X = 1) = 0$ *since this is a continuous distribution*
      iii. $\boldsymbol{P(X \leq 1) = .75}$
   c. $P(X \geq 1) = 1 - P(X < 1) + P(X = 1)$
      i. $P(X < 1) = \frac{y+2}{4} = .75$
      ii. $P(X = 1) = 0$
      iii. $1 - .75 + 0 = .25$
      iv. $\boldsymbol{P(X \geq 1) = .25}$
   d. $P(-1.5 < X < .5) =$
      i. $P(X < .5) - P(X \leq -1.5) =$
      ii. $\frac{.5+2}{4} = .625$
      iii. $\frac{-1.5+2}{4} = .125$
      iv. .625-.125 = .5
      v. $\boldsymbol{P(-1.5 < X < .5) = .5}$
   e. $P(|X|) > 1)$.
      i. $1 < |X| < 2$
      ii. $P(X \leq 2) = 1$
      iii. $P(X \leq 1) = .75$
      iv. $1. - 75 = .25$
      v. $\boldsymbol{P(|X|) > 1 = .25}$

CDF Graph for PS 2 #4