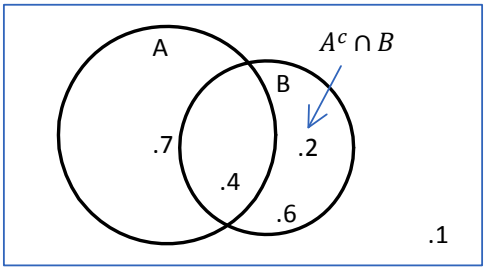
Problem Set 2

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 $A \cup B^C$?

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

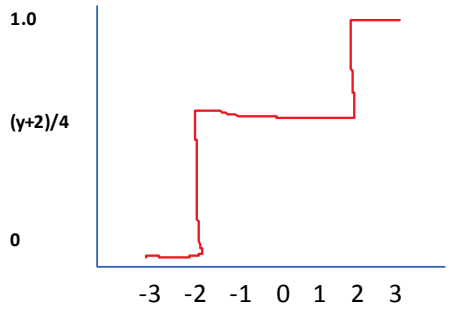
2. A statistics class contains 35 students: 11 undergrads and 24 grad students. Of the undergraduates, 4 are female and 7 and male. Of the grad students, 5 are female and 19 are male.
   (a) I randomly select a student from the class. Given that the student I select is a male, what is the conditional 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 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?
   -

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



exercises.r

Source on Save | Run | Source

```
1  print("Keith Hickman's R examples:")
2
3  ## x <- 10:20
4  ## y <- seq(from=1.8,to=2.2, length=length(x))
5
6  x + 100
7  x / y
8  x + y
```

6:1 (Top Level) R Script

Console ~/

```
> source('C:/Users/khickman/Desktop/Personal/IUMSDS/Stats S520/Module2/exercises.r')
[1] "Keith Hickman's R examples:"
> x + 100
 [1] 110 111 112 113 114 115 116 117 118 119 120
> x / y
 [1] 5.555556 5.978261 6.382979 6.770833 7.142857 7.500000 7.843137 8.173077 8.490566
[10] 8.796296 9.090909
> x + y
 [1] 11.80 12.84 13.88 14.92 15.96 17.00 18.04 19.08 20.12 21.16 22.20
> x * y
 [1] 18.00 20.24 22.56 24.96 27.44 30.00 32.64 35.36 38.16 41.04 44.00
> log(x)
 [1] 2.302585 2.397895 2.484907 2.564949 2.639057 2.708050 2.772589 2.833213 2.890372
[10] 2.944439 2.995732
> sqrt(x)
 [1] 3.162278 3.316625 3.464102 3.605551 3.741657 3.872983 4.000000 4.123106 4.242641
[10] 4.358899 4.472136
> exp(x)
 [1]     22026.47     59874.14    162754.79    442413.39   1202604.28   3269017.37
 [7]   8886110.52  24154952.75  65659969.14 178482300.96 485165195.41
> x ^ y
 [1]  63.09573  82.44466 106.87121 137.64842 176.36441 225.00000 286.02551 362.52149
 [9] 458.32939 578.23953 728.22568
> y-20
 [1] -18.20 -18.16 -18.12 -18.08 -18.04 -18.00 -17.96 -17.92 -17.88 -17.84 -17.80
> (x+y)*50
 [1]  590  642  694  746  798  850  902  954 1006 1058 1110
>
```