## Week 1

1. Consider influenza epidemics for two parent heterosexual families. Suppose that the probability is 17% that at least one of the parents has contracted the disease. The probability that the father has contracted influenza is 12% while the probability that both the mother and father have contracted the disease is 6%. What is the probability that the mother has contracted influenza?
2. A random variable, is uniform, a box from 0 to 1 of height 1. (So that its density is for ) What is its 75th percentile?
   1. qunif(0.75, min = 0, max = 1) = 0.75
3. You are playing a game with a friend where you flip a coin and if it comes up heads you give her dollars and if it comes up tails she gives you dollars. The probability that the coin is heads is (some number between and .) What has to be true about and to make so that both of your expected total earnings is . The game would then be called “fair”.
   1. Expected earnings: or

By algebraic manipulation:

1. A density that looks like a normal density (but may or may not be exactly normal) is exactly symmetric about zero. (Symmetric means if you flip it around zero it looks the same.) What is its median?
   1. The median must be 0.
2. Consider the following PMF shown below in R

x <- 1:4  
p <- x/sum(x)  
temp <- rbind(x, p)  
rownames(temp) <- c(“X”, “Prob”)  
temp  
  
## [,1] [,2] [,3] [,4]

## X 1.0 2.0 3.0 4.0

## Prob 0.1 0.2 0.3 0.4

What is the mean?

1. A web site ([www.medicine.ox.ac.uk/bandolier/band64/b64-7.html](http://www.medicine.ox.ac.uk/bandolier/band64/b64-7.html)) for home pregnancy tests cites the following: “When the subjects using the test were women who collected and tested their own samples, the overall sensitivity was 75%. Specificity was also low, in the range 52% to 75%.” Assume the lower value for the specificity. Suppose a subject has a positive test and that 30% of women taking pregnancy tests are actually pregnant. What number is closest to the probability of pregnancy given the positive test?

## Week 2

1. What is the variance of the distribution of the average an IID draw of observations from a population with mean and variance .

σ2

2σ/sqrt(n)

σ2/n​

σ/n

1. Suppose that diastolic blood pressures (DBPs) for men aged 35-44 are normally distributed with a mean of 80 (mm Hg) and a standard deviation of 10. About what is the probability that a random 35-44 year old has a DBP less than 70?

22%

32%

16%

8%

1. Brain volume for adult women is normally distributed with a mean of about 1,100 cc for women with a standard deviation of 75 cc. What brain volume represents the 95th percentile?

approximately 1223

approximately 1247

approximately 977

approximately 1175

1. Refer to the previous question. Brain volume for adult women is about 1,100 cc for women with a standard deviation of 75 cc. Consider the sample mean of 100 random adult women from this population. What is the 95th percentile of the distribution of that sample mean?

approximately 1112 cc

approximately 1115 cc

approximately 1088 cc

approximately 1110 cc

1. You flip a fair coin 5 times, about what's the probability of getting 4 or 5 heads?

12%

6%

19%

3%

1. The respiratory disturbance index (RDI), a measure of sleep disturbance, for a specific population has a mean of 15 (sleep events per hour) and a standard deviation of 10. They are not normally distributed. Give your best estimate of the probability that a sample mean RDI of 100 people is between 14 and 16 events per hour?

95%

34%

47.5%

68%

1. Consider a standard uniform density. The mean for this density is .5 and the variance is  
   1 / 12. You sample 1,000 observations from this distribution and take the sample mean, what value would you expect it to be near?

0.75

0.10

0.5

0.25

1. The number of people showing up at a bus stop is assumed to be Poisson with a mean of 5 people per hour. You watch the bus stop for 3 hours. About what's the probability of viewing 10 or fewer people?

0.03

0.08

0.12

0.06