Statistics 13 – Homework 3

Chapter 4 Homework Solutions

[**9**] The serum cholesterol levels of 17-year-olds follows a normal distribution with mean 176 mg/dLi and standard deviation 30 mg/dLi. What percentage of 17-year-olds have serum cholesterol values:

[**9a**] 186 or more? $P(X \geq 186) = 1 - .6293 = .3707$

[**9b**] 156 or less? $P(X \leq 156) = .2514$

[**9c**] 216 or less? $P(X \leq 216) = .9082$

[**9d**] 121 or more? $P(X \geq 121) = 1 - .0336 = .9664$

[**9e**] between 186 and 216? $P(186 < X < 216) = .9082 - .6293 = .2789$

[**9f**] between 121 and 156? $P(121 < X < 156) = .2514 - .0336 = .2718$

[**9g**] between 156 and 186? $P(156 < X < 186) = .6293 - .2514 = .3779$

[**11**] For the serum cholesterol distribution in 4.9, find

[**11a**] the 80th percentile: In Table 3, the area closest to .8 is .7995, corresponding to z = .84. Thus, the 80th percentile y* must satisfy the equation:

$$.84 = \frac{y * -176}{30}$$

which yields y* = (30)(.84) + 176 = 201.2 mg/dl.

[**11b**] the 20th percentile: the z score corresponding to the closest area is -.84 so we are solving the following equation for y*:

$$-.84 = \frac{y * -176}{30}$$

which yields y* = (30)(-.84) + 176 = 150.8 mg/dl.

[**22**] In the genetic studies of the fruitfly Drosophila melanogaster, one variable of interest is the total number of bristels on the ventral surface of the fourth and fifth dominal segments. for a certain Drosophila population, the bristle count follows approximately a normal distribution with mean 38.5 and standard deviation 2.9. Find (using the continuity correction):

[**22a**] the percentages of flies with 40 or more brisltes:

$$P(Y \geq 40) = P(Y > 39.5) \approx P\left[Z > \frac{39.5 - 38.5}{2.9}\right] = P(Z > .34) = 1 - .6331 = .3669$$

[**22b**] the percentage of flies with exactly 40 bristles:

$$P(Y = 40) = P(39.5 < Y < 40.5) \approx P\left[\frac{39.5 - 38.5}{2.9} < Z < \frac{40.5 - 38.5}{2.9}\right]$$

This is the probability that Z is between .34 and .69, which is .7549 - .6331 = .1218

[**22c**] the percentage of flies whose bristle count is between 35 and 40, inclusive:

$$P(35 \leq Y \leq 40) = P(34.5 < Y < 40.5) \approx P\left[\frac{34.5 - 38.5}{2.9} < Z < \frac{40.5 - 38.5}{2.9}\right]$$

This is the probability that Z is between -1.38 and .69, which is .7549 - .0838 = .6711

[**23**] Refer to the fruitfly population of Exercise 22. Let Y be the bristle count of a fly chosen at random from the population:

[**23a**] Use the continuity correction to calculate P($35 \leq Y \leq 40$): This is the same as part (c) of Exercise 4.22 (see above).

[**23b**] Calculate $P(35 \leq Y \leq 40)$ without the continuity correction and compare with the result of part (a):

$$P(35 < Y < 40) \approx P\left[\frac{35 - 38.5}{2.9} < Z < \frac{40 - 38.5}{2.9}\right]$$

This is the probability that Z is between -1.21 and .52, which is .6985 - .1131 = .5854. This does not agree very well with the answer from part (a).

[**41**] Resting heart rate was measured for a group of subjects; the subjects then drank 6 ounces of coffee. Ten minutes later their heart rates were measured again. The change in heart rate followed a normal distribution, with mean increase of 7.3 beats per minute and a standard deviation of 11.1. Let Y denote the change in heart rate for a randomly selected person. Find:

[**41a**] P(Y>10):

$$P(Y > 10) \approx P\left[Z > \frac{10 - 7.3}{11.1}\right]$$

This is the probability that Z is greater than .24, which is 1 - .5948 = .4052

[**41b**] P(Y>20):

$$P(Y > 20) \approx P\left[Z > \frac{20 - 7.3}{11.1}\right]$$

This is the probability that Z is greater than 1.14, which is 1 - .8729= .1271

[**41c**] P(5< Y <15):

$$P(5 < Y < 15) \approx P\left[\frac{5 - 7.3}{11.1} < Z < \frac{15 - 7.3}{11.1}\right]$$

This is the probability that Z is between -.21 and .69, which is .7549 - .4168 = .3381.

[**42**] Refer to the heart rate distribution of Exercise 4.41. The fact that the standard deviation is greater than the average and that the distribution is normal tells us that some of the data values are negative, meaning that the person's heart rate went down, rather than up. Find the probability that a randomly chosen person's heart rate will go down. That is, find P(Y<0):

$$P(Y < 0) \approx P\left[Z < \frac{0 - 7.3}{11.1}\right]$$

That is the probability that Z is less than -.66, which is .2546.

[**43**] Refer to the heart rate distribution of Exercise 4.41. Suppose we take a random sample of size 400 from this distribution. How many observations do we expect to obtain that fall between 0 and 15:

P(0< Y <15) = .7549 - .2546 = .5003. Thus we expect to find (400)(.5003), or about 200 observations to fall between 0 and 15.

[**44**] Refer to the heart rate distribution of Exercise 4.41. If we use the 1.5 * IQR rule, from Chapter 2, to identify outliers, how large would an observation need to be in order to be labelled an outlier?

First we need to figure out the IQR. The first and third quartiles are the 25th and 75th percentiles. The IQR is 14.74 - (-.14) = 14.88. An outlier on the high end of the distribution is any point greater than 14.74 + (1.5)(14.88) = 37.06.