Homework 3[1]

Questions 4.5

The yields of many agricultural plots is normally distributed with a mean of 88 lbs, and a standard deviation of 7 lbs.

a) $Pr\{Y \geq 80\} : Z = \frac{y-\mu}{\sigma} = \frac{80-88}{7} = -\frac{8}{7} : Pr\{Z \geq -1.14\} = 0.8729$

b) $Pr\{Y \geq 90\} : Z = \frac{y-\mu}{\sigma} = \frac{90-88}{7} = \frac{2}{7} : Pr\{Z \geq +0.29\} = 0.3859$

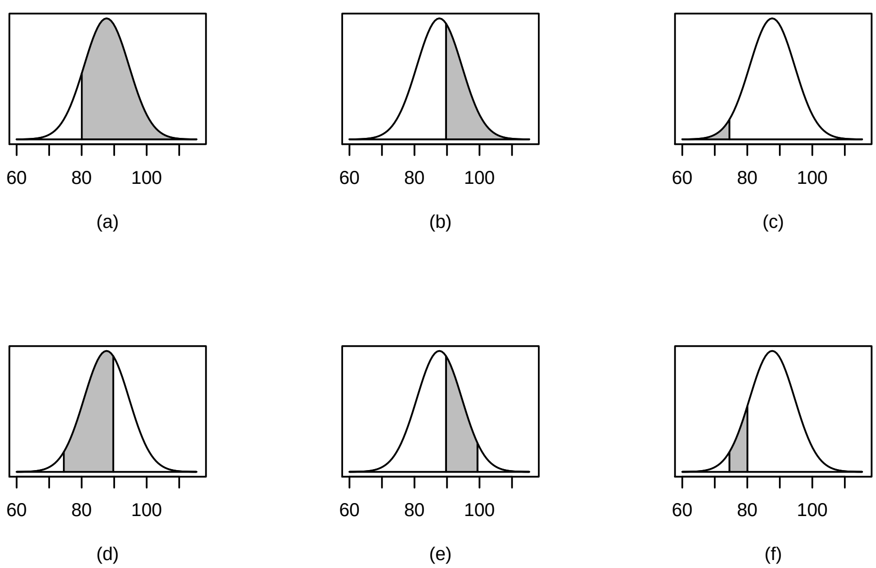
c) $Pr\{Y \leq 75\} : Z = \frac{y-\mu}{\sigma} = \frac{75-88}{7} = -\frac{13}{7} : Pr\{Z \leq -1.86\} = 0.0314$

d) $Pr\{75 \geq Y \geq 90\} : .6141 - .0314 = .5827$

e) $Pr\{90 \geq Y \geq 100\} : .9564 - .6141 = .3423$

f) $Pr\{75 \geq Y \geq 80\} : .1271 - .0314 = .0957$

Figure 1: Optional Images for Question 4.5



[1] While not required, some example images have been included for instructive purposes.

Question 4.12

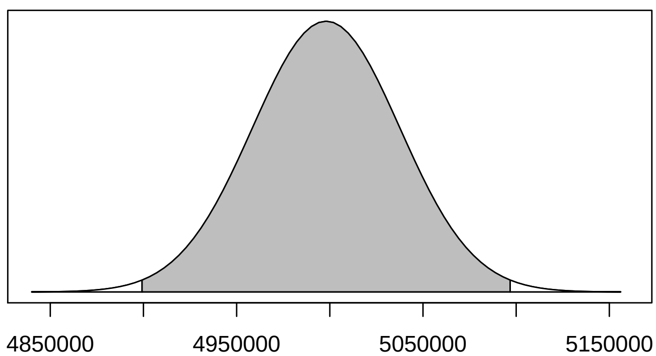
Red blood cells are counted using an electronic devise, which has a standard deviation of about %8 of the true value. Therefore, if the true value is $5,000,000$ $cell/mm^3$, then the SD is $40,000$.

a) $Pr\{4,900,000 \geq Y \geq 5,100,00\} : Pr\{\frac{4,900,000-5,000,000}{40,000} \geq Z \geq \frac{5,100,000-5,000,000}{40,000}\} :$
$Pr\{-2.5 \geq Z \geq 2.5\} = 0.9938 - 0.0062 = .9876$

b) We are asked to find the probability of being within 2% of the mean. Part (a) was an example of this, because 100,000 / 5,000,000 = 2%. Therefore, the answer to part(b) is the same as part(a) .9876.

c) In part(b) we establish the probability of being within 2% is .9876. Part(c) is asking about the complimentary event: being outside this range. Therefore the probability is $1 - .9876 = .0124$.

Figure 2: Optional Image for Question 4.12, Parts (a) and (b)



Question 4.25

In a certain population of healthy people the mean total protein concentration in the blood serum is 6.85 g/dLi, the standard deviation is .42 g/dLi, and the distribution is approximately normal. The instrument used reports the value to the nearest .1 g/dLi.

a) Because our instrument measures to the nearest tenth, we will consider the range from 6.54 to 6.55 when calculating $Pr\{Y = 6.5\}$.
$Pr\{Y \geq 6.45\} = Pr\{Z \geq \frac{6.45-6.85}{.42}\} = Pr\{Z \geq -.95\} = .1711$
$Pr\{Y \leq 6.55\} = Pr\{Z \leq \frac{6.55-6.85}{.42}\} = Pr\{Z \leq -.71\} = .2389$
Therefore, $Pr\{Y = 6.5\} = .2389 - .1711 = .0678$

b) $Pr\{6.5 \geq Y \geq 8.0\} : Pr\{Y \leq 8.05\} = Pr\{Z \leq \frac{8.05-6.85}{.42}\} = Pr\{Z \leq 2.86\} = .9979$
$Pr\{6.5 \geq Y \geq 8.0\} = .9979 - .1711 = .8265$

Question 4.34

In the nerve-cell activity of a certain individual fly, the time intervals between "spike" discharges follow approximately a normal distribution with mean 15.6 ms and standard deviation .4ms.

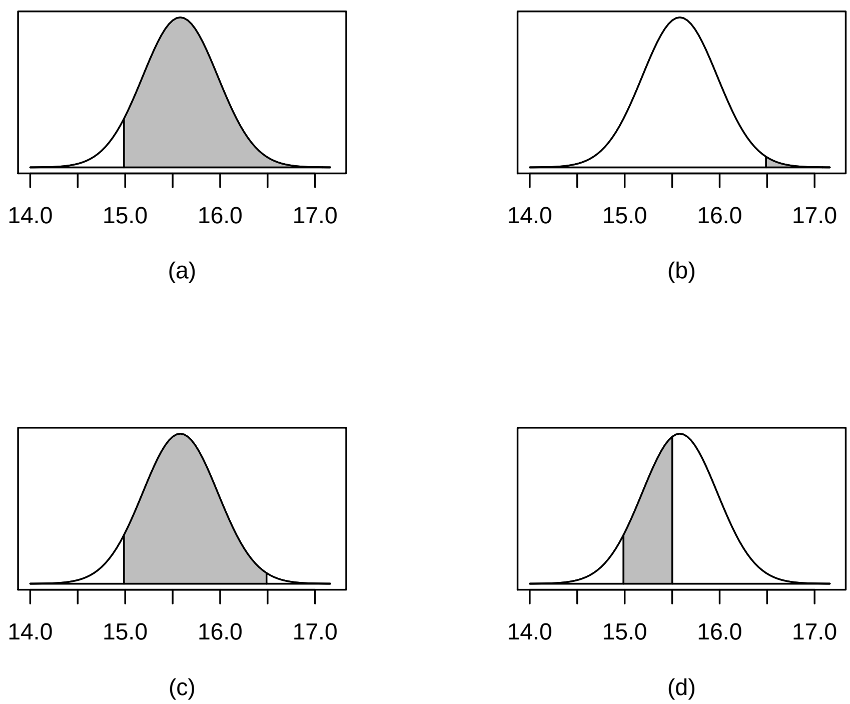
a) $Pr\{Y > 15\} = 1 - Pr\{Y < 15\} = 1 - Pr\{Z < \frac{15-15.6}{.4}\} = 1 - Pr\{Z < -1.5\} = 1 - .0668 = .9332$

b) $Pr\{Y > 16.5\} = 1 - Pr\{Y < 16.5\} = 1 - Pr\{Z < \frac{16.5-15.6}{.4}\} = 1 - Pr\{Z < 2.25\} = 1 - .9878 = .0122$

c) $Pr\{15 < Y < 16.5\} = Pr\{Y < 16.5\} - Pr\{Y < 15\} = .9878 - .0668 = .9210$

d) $Pr\{15 < Y < 15.5\} = Pr\{Y < 15.5\} - Pr\{Y < 15\} = .4013 - .0668 = .3345$

Figure 3: Optional Images for Question 4.34



Question 4.37

IQ is normally distributed with mean 100, and standard deviation 16.

a) Without continuity correction -
$Pr\{Y > 140\} = 1 - Pr\{Y < 140\} = 1 - Pr\{Z < \frac{140-100}{16}\} = 1 - Pr\{Z < 2.5\} = 1 - .9938 = .0062$

a) With (optional) continuity correction -
$Pr\{Y \geq 140\} = Pr\{Y > 139.5\} = 1 - Pr\{Y < 139.5\} = 1 - Pr\{Z < \frac{139.5-100}{16}\} = 1 - Pr\{Z < 2.47\} = 1 - .9932 = .0068$

b) Without continuity correction -
$Pr\{Y < 80\} = Pr\{Z < \frac{80-100}{16}\} = Pr\{Z < -1.25\} = .1056$

b) With (optional) continuity correction -
$Pr\{Y \leq 80\} = Pr\{Y < 80.5\} = Pr\{Z < \frac{80.5-100}{16}\} = Pr\{Z < -1.22\} = .1112$

c) $Pr\{80 < Y < 120\} = Pr\{Y < 120\} - Pr\{Y < 80\} = .8944 - .1056 = .7888$

d) $Pr\{80 < Y < 140\} = Pr\{Y < 140\} - Pr\{Y < 80\} = .9938 - .1056 = .8882$

e) $Pr\{120 < Y < 140\} = Pr\{Y < 140\} - Pr\{Y < 120\} = .9938 - .8944 = .0994$

*(In parts (a) and (b) we are including optional calculations with the continuity correction, because the text suggests using the correction for inclusive (ie. "or more") type probabilities.)

Question 4.45

Histogram I is roughly normal, and corresponds to qq (b).

Histogram II is right skewed, and corresponds to qq (d).

Histogram III is short tailed, and corresponds to qq (a).