20220318 415 HW 5

7.4-3. A company packages powdered soap in "6-pound" boxes. The sample mean and standard deviation of the soap in these boxes are currently 6.09 pounds and 0.02 pound, respectively. If the mean fill can be lowered by 0.01 pound, \$14,000 would be saved per year. Adjustments were made in the filling equipment, but it can be assumed that the standard deviation remains unchanged.

(a) How large a sample is needed so that the maximum error of the estimate of the new μ is $\varepsilon = 0.001$ with 90% confidence?

(b) A random sample of size $n = 1219$ yielded $\bar{x} = 6.048$ and $s = 0.022$. Calculate a 90% confidence interval for μ.

(c) Estimate the savings per year with these new adjustments.

(d) Estimate the proportion of boxes that will now weigh less than 6 pounds.

90% is 1.645

SD = 0.02

a)

$$\frac{(1.645 \cdot 0.02)}{0.001} = 32.9$$

$$32.9^2 = 1082.41$$

b)

$n = 1219$

$\bar{x} = 6.048$

$s = 0.022$

$$1.645 \cdot \frac{0.022}{\sqrt{1219}} = 0.001$$

6.048 ± 0.001

$= (6.047, 6.049)$

c)

$(6.09 - 6.048) \cdot 14000$

$= \$588$

d) $P(x < 6.00)$

$= P\left(z < \frac{6 - 6.048}{0.022}\right)$

$= 0.0146$

7.4-7. For a public opinion poll for a close presidential election, let p denote the proportion of voters who favor candidate A. How large a sample should be taken if we want the maximum error of the estimate of p to be equal to

(a) 0.03 with 95% confidence?

(b) 0.02 with 95% confidence?

(c) 0.03 with 90% confidence?

set $p = 0.5$

a) $0.5(1-0.5)\left(\frac{1.96}{0.03}\right)^2$

$= 1067.1$

b) $0.5(1-0.5)\left(\frac{1.96}{0.02}\right)^2$

$= 2401$

c) $0.5(1-0.5)\left(\frac{1.645}{0.03}\right)^2$

$= 751.67$

7.4-8. Some college professors and students examined 137 Canadian geese for patent schistosome in the year they hatched. Of these 137 birds, 54 were infected. The professors and students were interested in estimating p, the proportion of infected birds of this type. For future studies, determine the sample size n so that the estimate of p is within $\varepsilon = 0.04$ of the unknown p with 90% confidence.

$$= \frac{(1.645)^2 \left(\frac{54}{137}\right)\left(1-\frac{54}{137}\right)}{(6.04)^2}$$

$$= 403.87$$

6.5.3. The midterm and final exam scores of 10 students in a statistics course are tabulated as shown.

(a) Calculate the least squares regression line for these data.

(b) Plot the points and the least squares regression line on the same graph.

(c) Find the value of $\widehat{\sigma^2}$.

Midterm	Final	Midterm	Final
70	87	67	73
74	79	70	83
80	88	64	79
84	98	74	91
80	96	82	94

$n = 10$

$\Sigma mid = 745$ $\quad \overline{mid} = 74.5$

$\Sigma final = 868$ $\quad \overline{final} = 86.8$

$\Sigma mid^2 = 55917$ $\quad \Sigma mid \times final = 65087$

$\Sigma final^2 = 75950$

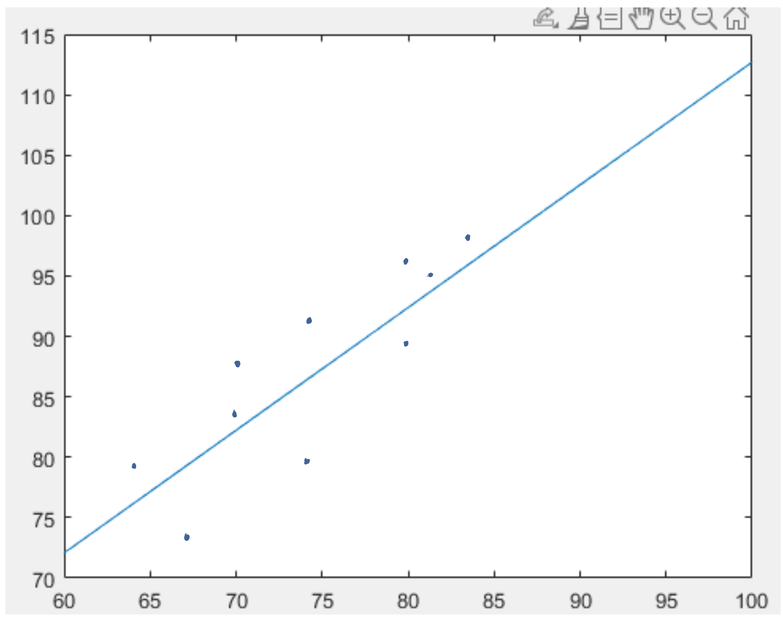
a) $b = \dfrac{65087 - 10 \times 74.5 \times 86.8}{55917 - 10 \times (74.5)^2}$

$a = 86.8 - 1.0157 \times 74.5 \quad = 1.0157$

$= 11.1305$

$y = 11.130 + 1.0157x$

b)



c) $\widehat{\sigma^2} = \dfrac{\sum_{i=1}^{10} (final_{(i)} - \overline{final})^2 - 1.0157 \cdot \sum_{i=1}^{10} (final_i - \overline{final})(mid_i - \overline{mid})}{n-2}$

$= \dfrac{607.6 - 1.0157 \times 429}{8}$

$= 22.4988$

6.5-5. A student who considered himself to be a "car guy" was interested in how the horsepower and weight of a car affected the time that it takes the car to go from 0 to 60 mph. The following table gives, for each of 14 cars, the horsepower, the time in seconds to go from 0 to 60 mph, and the weight in pounds:

Horsepower	0–60	Weight	Horsepower	0–60	Weight
230	8.1	3516	282	6.2	3627
225	7.8	3690	300	6.4	3892
375	4.7	2976	220	7.7	3377
322	6.6	4215	250	7.0	3625
190	8.4	3761	315	5.3	3230
150	8.4	2940	200	6.2	2657
178	7.2	2818	300	5.5	3518

(a) Calculate the least squares regression line for "0–60" versus horsepower.

(b) Plot the points and the least squares regression line on the same graph.

(c) Calculate the least squares regression line for "0–60" versus weight.

(d) Plot the points and the least squares regression line on the same graph.

(e) Which of the two variables, horsepower or weight, has the most effect on the "0–60" time?

$n = 14$

$\Sigma H = \Sigma \text{horsepower} = 3537 \quad \Sigma H^2 = 947767$

$\bar{H} = 252.643$

$\Sigma S = \Sigma 0\text{-}60 = 95.5 \quad \Sigma s^2 = 9120.25$

$\bar{S} = 6.8214$

$\Sigma W = \Sigma \text{weight} = 47842 \quad \Sigma w^2 = 228856964$

$\bar{W} = 3417.2857$

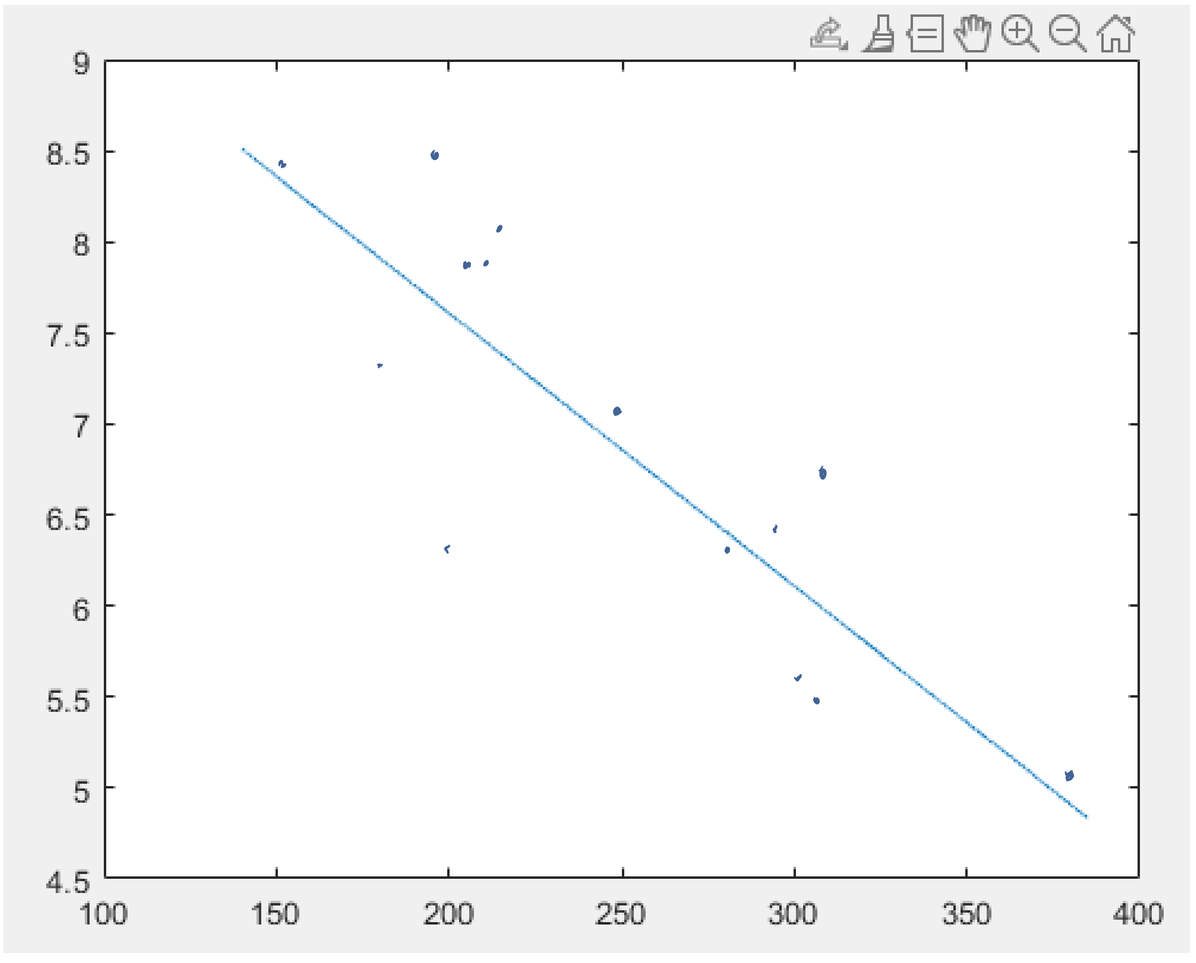
$\Sigma H \cdot S = 316773.5$

$\Sigma W \cdot S = 4568911$

a)

$$b = \frac{\Sigma H \cdot S - 14 \cdot \bar{H} \cdot \bar{S}}{\Sigma H^2 - 14 \cdot (\bar{H})^2} = -0.0150$$

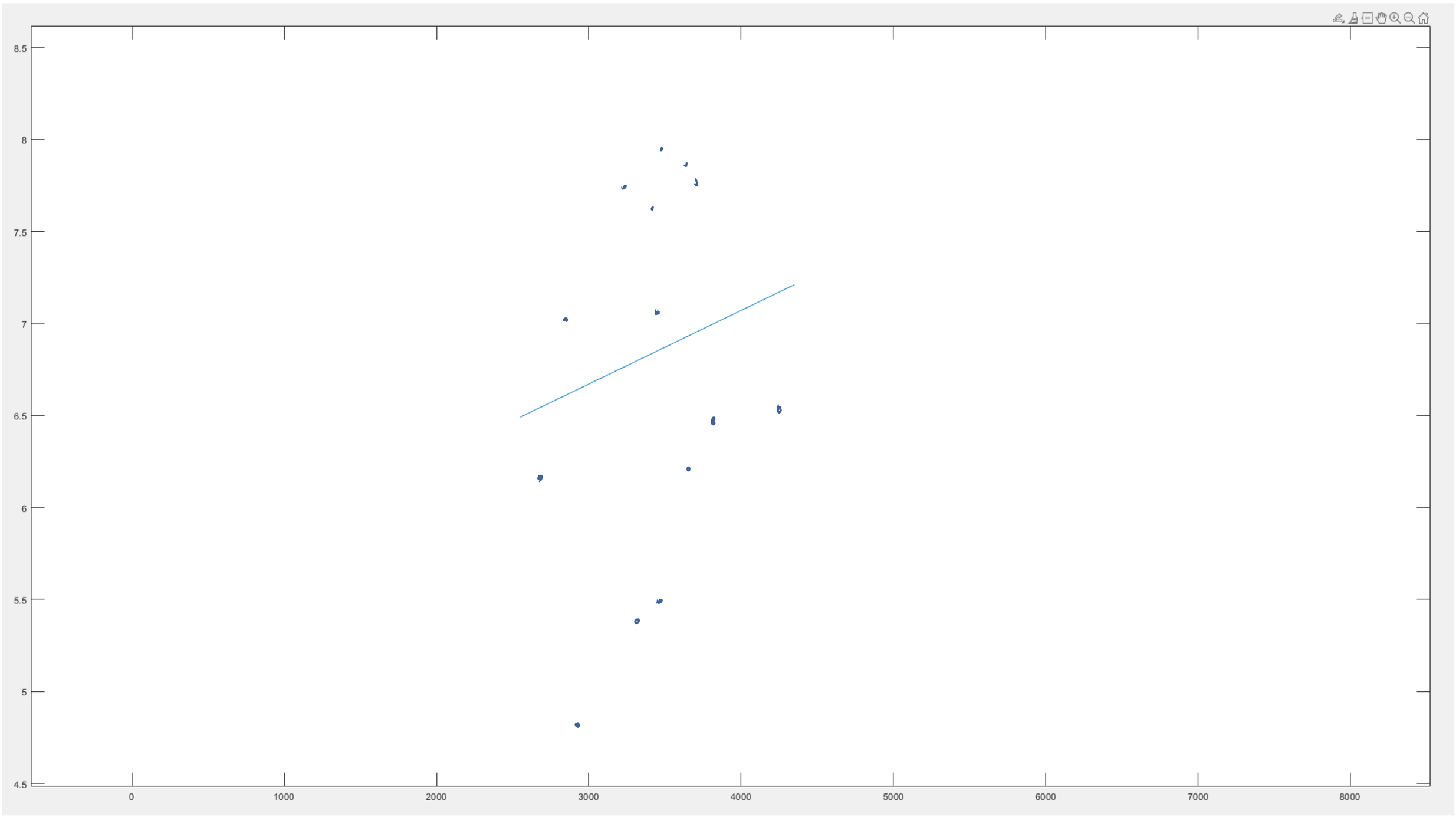
$$a = \bar{S} - b \cdot \bar{H} = 10.6095$$



c) $b = \frac{2557638.86}{1010.542} = 0.0004$

$a = \bar{s} - b \cdot \bar{w}$

$= 5473$



e) hourse power is more related to 0-60 time