1. c. The interquartile range increases.
2. 0.003348589
3. --
4. $b_0 = y$-intercept and $b_1 = \text{slope}$, Which of these will best explain the relationship between $x$ and $y$? $b_1$
5. --
6. d. Deciding to go for the first down when his team will not get the first down.
7. 15/43
8. 9/20
9. a. [17.01, 26.79]
   b. [29.75313, 170.9206]
10. $P \left(Z < \frac{\left(\frac{7020}{52}\right) - 140}{\sqrt{52}}\right)$
11. b. two-sample t-test for means
12. new mean = 5.64, new $s=1.32$
14. Median = 3.5 kg, shape is skewed right
15. A and C have reasonable intervals, but B does not.
16. [0.621, 0.779]
17. a. Fail to reject $H_0$ at $\alpha = 0.05$
   \[H_0 : \mu = 33.5\]
   \[H_a : \mu \neq 33.5\]
   \[t = \frac{31.6 - 33.5}{3.4 / \sqrt{12}} = -1.936\]
   \[p(t \neq 1.936) = 2 \cdot p(t < 1.936) = 0.07897696\]
   b. Reject $H_0$ at $\alpha = 0.05$
   \[H_0 : \mu = 33.5\]
   \[H_a : \mu < 33.5\]
   \[t = \frac{31.6 - 33.5}{3.4 / \sqrt{12}} = -1.936\]
   \[p(t < -1.936) = p(t < -1.936) = 0.03948848\]
   c. two-sided t test vs. one-sided t test.
18. a. 1/4  b. 3/4
19. a. $\hat{y} = -0.9644 + 0.0105x$  b. $\hat{y} = 0.5742 + 0.0137x$  c. IT (higher $R^2$ and lower $p$-value)
20. a. np=2, too small
   b. since np and n(1-p) must each be at least 10, we will need 500 parts to sample
   c. Fail to reject H₀ at \( \alpha = 0.05 \)

\[
\begin{align*}
H₀ : \rho &= 0.02 \\
Hₐ : \rho &\neq 0.02 \\
H₀ : \rho &= 0.02 \\
Hₐ : \rho &> 0.02
\end{align*}
\]

\[
z = \frac{0.03 - 0.02}{\sqrt{0.02(0.98)/500}} = 1.597 \quad \text{and} \quad z = \frac{0.03 - 0.02}{\sqrt{0.02(0.98)/500}} = 1.597
\]

\[
p(z \neq 1.597) = 2 \cdot p(z > 1.597) = 0.1102657 \quad p(z > 1.597) = 0.05513285
\]

21. Fail to reject the null hypothesis. (This is a two sided proportions test, the test statistic is 0.3333 which does not fall in the rejection region for 1% significance)

22. Reject H₀ at \( \alpha = 0.05 \)

\[
\begin{align*}
H₀ : \mu &= 32 \\
Hₐ : \mu &\neq 32
\end{align*}
\]

\[
t = \frac{35 - 32}{5 / \sqrt{64}} = 4.8
\]

\[
p(t \neq 4.8) = 2 \cdot p(t > 4.8) = 1.014185e-05
\]

23. (two sample z test since we have population sd)
   test statistic is \( z = -7.28 \Rightarrow \) Reject the null and conclude there is a difference in the means.

24. 0.420117
25. -0.5244005
26. 0.0306
27. 1.396815
28. 0.02550163
29. 1537
30. matched pairs t-test. Reject the null hypothesis

\[
\begin{align*}
H₀ : \mu₀ &= 0 \\
Hₐ : \mu₀ &> 0
\end{align*}
\]

\[
t = 33.3 / \sqrt{26.39044} / \sqrt{10} = 3.99
\]

\[
p(t > 3.99) = 0.001578866
\]

31. a. success/fail, same prob for success, independent trials
   b. \( \text{dbinom}(4, 6, 0.9) = 0.098415 \)
   c. \( \text{pbinom}(2, 6, 0.9) = 0.00127 \)
   d. \( 1 - \text{pbinom}(4, 6, 0.9) = 0.885735 \) (remember, this is discrete data)

32. for \( Hₐ : \text{not all same} \), based on p-value given for data, reject the null at 5%

33. \[
\int_0^a \frac{1}{2} x^2 dx = \frac{1}{6} x^3 \bigg|_0^a = \frac{1}{6} a^3 = 1 \rightarrow a = \sqrt[3]{6}
\]

34. 98
35. Fail to reject the null hypothesis

\[ H_0 : \mu_a = \mu_b \]

\[ H_a : \mu_a \neq \mu_b \]

\[
t = \frac{18.56 - 17.95}{\sqrt{\frac{4.35^2}{65} + \frac{4.87^2}{75}}} = 0.783
\]

\[
p(t \neq 0.783) = 2 \cdot p(t > 0.783) = 0.436515
\]

36. a. \( f = \text{MSTr}/\text{MSE} = 9.722 \)

b. p-value = 1 - pf(9.722, 3, 16) = 0.000685104; Reject H0; Pairs that differ significantly will have \( w = \text{qtukey}(0.95, 4, 16) \sqrt{1.331/5} = 2.087564; (1,2), (1,3), (4,2), (4,3) \)

37. Reject H0

\[ H_0 : \rho_r = \rho_n \]

\[ H_a : \rho_r > \rho_n \]

\[
z = \frac{74 - A}{\sqrt{86 \left( \frac{54}{140} \left( \frac{1}{100} + \frac{1}{40} \right) \right)}} = 3.29
\]

\[
p(z > 3.29) = 0.0005009369
\]

38. Reject H0

\[ H_0 : \rho = 0.8 \]

\[ H_a : \rho < 0.8 \]

\[
z = \frac{77 - 0.8}{\sqrt{8.2/110}} = -2.622
\]

\[
p(z < -2.622) = 0.004370772
\]

39. Reject the null hypothesis

\[ H_0 : \mu_1 = \mu_2 \]

\[ H_a : \mu_1 > \mu_2 \]

\[
t = \frac{85 - 83}{\sqrt{\frac{3^2}{75} + \frac{2^2}{60}}} = 4.629 \text{ (use df = 59)}
\]

\[
p(t > 4.629) = 1.032084 \times 10^{-5}
\]
40. a. \( \hat{y} = -46.425 + 1.158x \) \( r = 0.9255 \) \( r^2 = 0.8566 \)
b. \( b = 1.158 \) \( t^* = 1.860 \) \( SE_b = 0.1676 \)
\[
b \pm t^*SE_b
\]
\[
1.158 \pm 1.860 \cdot 0.1676
\]
\[
(0.846, 1.467)
\]
This means that I am 90% confident the true slope of the LSRL of math and verbal scores on the SAT will lie in this interval. OR: I am 90% confident that for every 1 point increase in math SAT score, the average increase in verbal SAT score will be between 0.846 and 1.467.
c. \[ H_0 : \beta = 0 \quad H_a : \beta \neq 0 \]
\[ t = 6.912 \]
\[ P(b \neq 0) = P(t \neq 6.912) = 0.000123 \]
Conclusion: Based on 5% significance level, I will reject the null hypothesis which states that there is no linear relationship between math and verbal scores on the SAT.

41. a. \( \hat{y} = 12.96 + 4.0162x \)
b. On average, for each 1 point increase in the problem solving sub score, the was an increase of 4.0162 points in the total score.
c. \( R^2 \) indicates that 62% of the variation in total scores can be explained by the LSRL of total scores on problem solving sub score.
d. \[ n = 36 \Rightarrow df = 34 \Rightarrow t^* = 2.032 \]
\[
b \pm t^*SE_b
\]
\[
4.0162 \pm 2.032 \cdot 0.5393
\]
\[
(2.920, 5.112)
\]
e. All assumptions check.
\[ H_0 : \beta = 0 \quad H_a : \beta \neq 0 \]
\[ t = 7.45 \text{ from printout} \]
\[ t = \frac{4.0162}{0.5393} \text{ formula} \]
\[ P(b \neq 0) = P(t \neq 7.45) = 0.000 \]
\[ 6.0613 \times 10^{-9} \text{ using tcdf on calculator} \]
Based on 5% significance level I will reject the null hypothesis which states that there is no linear relationship between problem solving sub scores and total scores on the exam.