Contents

Chapter 1: Descriptive Statistics 1

Chapter 2: Essentials of Probability and Estimation Procedures 7

Chapter 3: Interval Estimates and the Central Limit Theorem 13

Chapter 4: Estimation Procedures, Estimates, and Hypothesis Testing 21

Chapter 5: Ordinary Least Squares Estimation Procedure—The Mechanics 25

Chapter 6: Ordinary Least Squares Estimation Procedure—The Properties 31

Chapter 7: Estimating the Variance of an Estimate's Probability Distribution 37

Chapter 8: Interval Estimates and Hypothesis Testing 41

Chapter 9: One-Tailed Tests, Two-Tailed Tests, and Logarithms 49

Chapter 10: Multiple Regression Analysis—Introduction 59

Chapter 11: Hypothesis Testing and the Wald Test 63

Chapter 12: Model Specification and Development 67

Chapter 13: Dummy and Interaction Variables 73

Chapter 14: Omitted Explanatory Variables, Multicollinearity, and Irrelevant Explanatory Variables 77

Chapter 15: Other Regression Statistics and Pitfalls 83

Chapter 16: Heteroskedasticity 89

Chapter 17: Autocorrelation (Serial Correlation) 95

Chapter 18: Explanatory Variable/Error Term Independence Premise, Consistency, and Instrumental Variables 99

Chapter 19: Measurement Error and the Instrumental Variables Estimation Procedure 101

Chapter 20: Omitted Variables and the Instrumental Variable Estimation Procedure 105

Chapter 21: Panel Data and Omitted Variables 109

Chapter 22: Simultaneous Equations Models—Introduction 113

Chapter 23: Simultaneous Equations Models—Identification 117

Chapter 24: Binary and Truncated Dependent Variables 123

Chapter 25: Descriptive Statistics, Probability, and Random Variables—A Closer Look 129

Chapter 26: Estimating the Mean of a Population 133

Chapter 1: Descriptive Statistics

Solutions to Chapter 1 Prep Questions

1. One reasonable way would be to calculate the average precipitation for each month and then choose the month with the highest average.

Solutions to Chapter 1 Review Questions

1. a. The mean is the average of the values. It describes the center of the distribution.

   b. $\text{Mean}[\boldsymbol{x}] = \dfrac{\sum_{t=1}^{T} x_t}{T}$

3. A histogram illustrates how the values of a single data variable are distributed.

5. a. Yes.
   b. No.

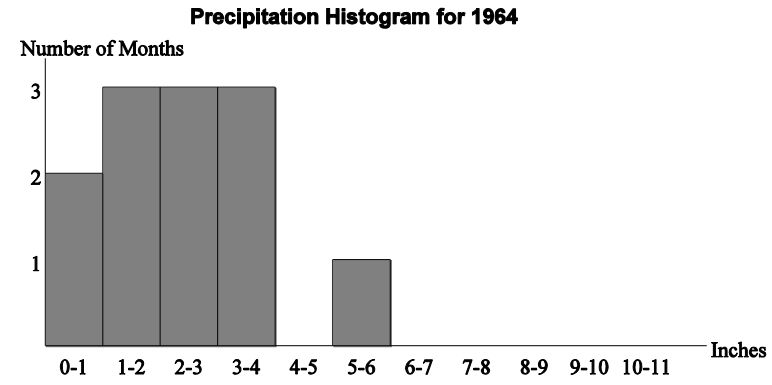
7. a. $\text{Cov}[\boldsymbol{x}, \boldsymbol{y}] > 0$ $\quad 0 < \text{CorrCoef}[\boldsymbol{x}, \boldsymbol{y}] \leq 1$
   b. $\text{Cov}[\boldsymbol{x}, \boldsymbol{y}] < 0$ $\quad -1 \leq \text{CorrCoef}[\boldsymbol{x}, \boldsymbol{y}] < 0$
   c. $\text{Cov}[\boldsymbol{x}, \boldsymbol{y}] \approx 0$ $\quad \text{CorrCoef}[\boldsymbol{x}, \boldsymbol{y}] \approx 0$

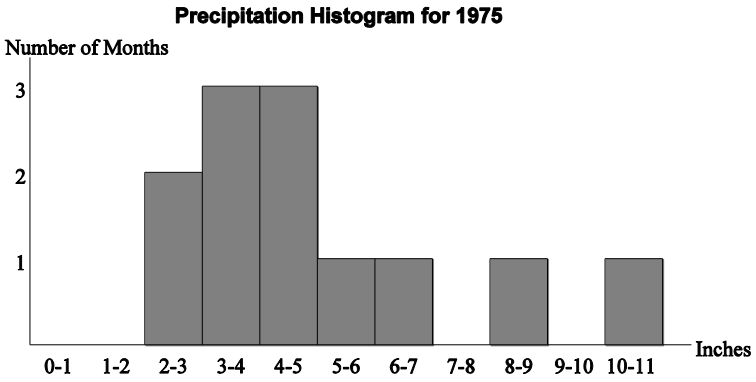
Solutions to Chapter 1 Exercises

1. a.

Inches of Precipitation	1964	1975
0–1	2	0
1–2	3	0
2–3	3	2
3–4	3	3
4–5	0	3
5–6	1	1
6–7	0	1
7–8	0	0
8–9	0	1
9–10	0	0
10–11	0	1

b.

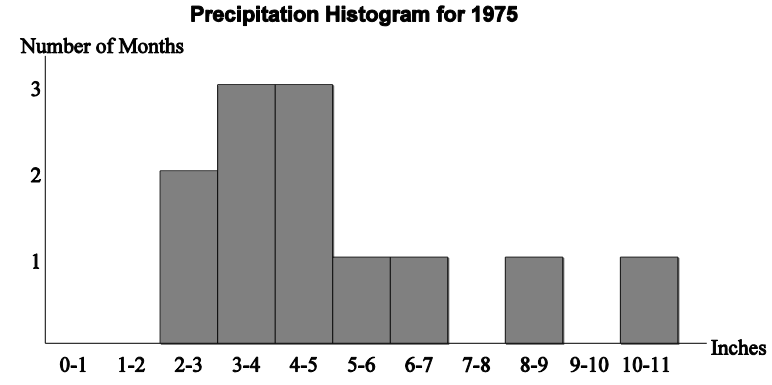


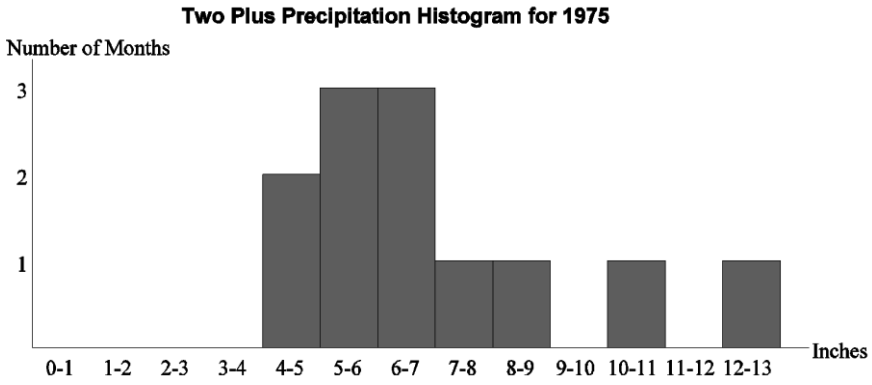


3. a.

1975	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precip	4.39	3.04	3.97	2.87	2.10	4.68	10.56	6.13	8.63	4.90	5.08	3.90
TwoPlusPrecip	6.39	5.04	5.97	4.87	4.10	6.68	12.56	8.13	10.63	6.90	7.08	5.90

b.





i. The histograms have identical shape. The *TwoPlusPrecip* histogram is just "slided" 2 inches to the right.

ii. The center has risen (shifted to the right) by 2 inches.

iii. The spread is unchanged.

c. i. Mean[T*woPlusPrecip*] = Mean[**2 + *Precip***]
= 2 + Mean[***Precip***]
= 2 + 5.02
= 7.02

ii. Var[*TwoPlusPrecip*] = Var[**2 + *Precip***]
= Var[***Precip***]
= 5.41

d. i. 7.02

ii. 64.91

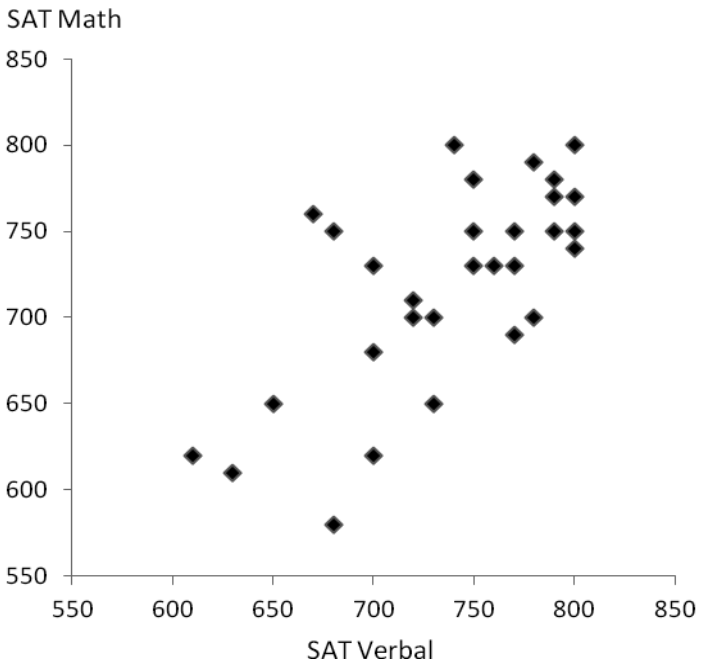
iii. 5.41

e. Yes, the answers are consistent. The histogram reveals that the

- center of the *TwoPlusPrecip* distribution is farther to the right; this is consistent with its higher mean.
- spread of the two distributions is the same; this is consistent with their equal variances.

The appropriate equation and statistical software provide the same answers.

5. a.



b. Yes, *SatMath* and *SatVerbal* appear to be correlated. As *SatVerbal* increases, *SatMath* tends to increase also.

c.

	SatMath	***SatVerbal***
Mean	737.0	719.0
Variance	2,774.3	3,402.3
Covariance	2,103.7	
Correlation Coefficient	.6847	

d. i. Mean[***SatSum***]= Mean[***SatMath***] + Mean[***SatVerbal***]
= 737.0 + 719.0
= 1,456.0

ii. Var[***SatSum***] = Var[***SatMath***] + 2Cov[***SatMath***, ***SatVerbal***] + Var[***SatVerbal***]
= 2,774.3 + 2×2,103.7 + 3,402.3
= 10,384.0

e. i. 1,456.0
ii. 311,520
iii. 10,384.0

f. Yes

7. a. $\text{Mean}[\textbf{\textit{SatMath}}] = \dfrac{x_1 + x_2 + \ldots + x_{30}}{30}$

$= \dfrac{x_1 + x_2 + \ldots + x_{10} \; + \; x_{11} + x_{12} + \ldots + x_{30}}{30}$

$= \dfrac{x_1 + x_2 + \ldots + x_{10}}{30} + \dfrac{x_{11} + x_{12} + \ldots + x_{30}}{30}$

$$= \frac{10}{30}\times\frac{x_1+x_2+\ldots+x_{10}}{10} + \frac{20}{30}\times\frac{x_{11}+x_{12}+\ldots+x_{30}}{20}$$

$$= \frac{1}{3}\times \text{Mean}[\textbf{\textit{SatMathFemale}}] + \frac{2}{3}\times \text{Mean}[\textbf{\textit{SatMathMale}}]$$

$$= Wgt_{Female}\,\text{Mean}[\textbf{\textit{SatMathFemale}}] + Wgt_{Male}\text{Mean}[\textbf{\textit{SatMathMale}}]$$

b. $Wgt_{Female} + Wgt_{Male} = \frac{1}{3} + \frac{2}{3} = 1$

c. Mean[***SatMath***] = 737
Mean[***SatMathFemale***] = 725
Mean[***SatMathMale***] = 743
Yes, the results are consistent.

$$\text{Mean}[\textbf{\textit{SatMath}}] = Wgt_{Female}\,\text{Mean}[\textbf{\textit{SatMathFemale}}] + Wgt_{Male}\text{Mean}[\textbf{\textit{SatMathMale}}]$$

$$= \frac{10}{30}\times \text{Mean}[\textbf{\textit{SatMathFemale}}] + \frac{20}{30}\times\text{Mean}[\textbf{\textit{SatMathMale}}]$$

$$= \frac{1}{3}\times \text{Mean}[\textbf{\textit{SatMathFemale}}] + \frac{2}{3}\times\text{Mean}[\textbf{\textit{SatMathMale}}]$$

$$= \frac{1}{3}\times 725 + \frac{2}{3}\times 743$$

$$= \frac{725+1,486}{3} = \frac{2,211}{3} = 737$$