# *Sahar* Guess paper

## Business Statistics (1430)*for* B.A/B.Com

**Q1:** Refer to Table 2-2 on page 24 and construct a relative frequency distribution using intervals of 4.0 ib/sq in. What do you conclude from this distribution?

**Solution:**

| Classes | Tally | f | r.f |
|---|---|---|---|
| 2490.0 ____ 2493.9 | ~~\|\|\|\|~~ \| | 6 | 0.15 |
| 2494.0 ____ 2497.9 | ~~\|\|\|\|~~ \|\| | 7 | 0.17 |
| 2498.0 ____ 2501.9 | ~~\|\|\|\|~~ ~~\|\|\|\|~~ \|\|\| | 13 | 0.32 |
| 2502.0 ____ 2505.9 | ~~\|\|\|\|~~ \|\|\|\| | 9 | 0.23 |
| 2506.0 ____ 2509.9 | ~~\|\|\|\|~~ | 5 | 0.13 |
| — | | $\sum f = 40$ | 1 |

**Q1.1:** The Bureau of Labor Statistics has sampled 30 communities nationwide and compiled prices in each community at the beginning and end of August in order to find out approximately how the Consumer price index (CPI) has changed during August. The percentage changes in prices for the 30 communities are as follows:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 0.7 | 0.4 | -0.3 | 0.2 | -0.1 | 0.1 | 0.3 | 0.7 | 0.0 | -0.4 |
| 0.1 | 0.5 | 0.2 | 0.3 | 1.0 | -0.3 | 0.0 | 0.2 | 0.5 | 0.1 |
| -0.5 | -0.3 | 0.1 | 0.5 | 0.4 | 0.0 | 0.2 | 0.3 | 0.5 | 0.4 |

**a)** Arrange the data in an array from lowest to highest.

**b)** Using the following four equal-sized classes, create a frequency distribution: -0.5 to -0.2, -0.1 to 0.2, 0.3 to 0.6, and 0.7 to 1.0.

c) **How many communities had prices that either did not change or that increased less than 1.0 percent?**

d) **Are these data discrete of continuous?**

**Solution:**

| | | |
|---|---|---|
| -0.5 | 0.1 | 0.4 |
| -0.4 | 0.1 | 0.4 |
| -0.3 | 0.1 | 0.4 |
| -0.3 | 0.2 | 0.5 |
| -0.3 | 0.2 | 0.5 |
| -0.1 | 0.2 | 0.5 |
| 0.0 | 0.2 | 0.5 |
| 0.0 | 0.3 | 0.7 |
| 0.0 | 0.3 | 0.7 |
| 0.1 | 0.3 | 1.0 |

(b)

| Classes | Tally | f |
|---|---|---|
| -0.5 to -0.2 | 𝍸 | 5 |
| -0.1 to 0.2 | 𝍸 𝍸 \|\| | 12 |
| 0.3 to 0.6 | 𝍸 𝍸 | 10 |
| 0.7 to 1.0 | \|\|\| | 3 |
| – | – | $\sum f = 30$ |

(c) 29

(d) Continuous

**Q1.2: Sarah Anne Rapp, the president of Baggit, Inc, has just obtained some raw data from a marketing survey that her company recently conducted. The survey was taken to determine the effectiveness of the new company slogan, "When you've given up on the rest, Baggit!" To determine the effect of the slogan on the sales of Luncheon Baggits, 20**

people were asked how many boxes of Luncheon Baggits per month they bought before and after the slogan was used in the advertising campaign. The results were as follows.

| Before | After | Before | After | Before | After | Before | After |
|---|---|---|---|---|---|---|---|
| 4 | 3 | 2 | 1 | 5 | 6 | 8 | 10 |
| 4 | 6 | 6 | 9 | 2 | 7 | 1 | 3 |
| 1 | 5 | 6 | 7 | 6 | 8 | 4 | 3 |
| 3 | 7 | 5 | 8 | 8 | 4 | 5 | 7 |
| 5 | 5 | 3 | 6 | 3 | 5 | 2 | 2 |

a) Create both frequency and relative frequency distributions for the "Before" responses, using as classes 1-2,3-4,5-6,7-8, and 9-10.

b) Work part(a) for the "After" responses.

c) Give the most basic reason why it makes sense to use the same classes for both the "Before" and "After" responses.

d) For each pair of "Before" and "After" responses, subtract the "Before" response from the "After" response to get the number that we will call "Change" (example: 3 -4 = -1), and create frequency and relative frequency distributions for "Change" using classes -5 to -4, -3 to2, -1 to 0, 1 to 2, 3 to 4,and 5 to 6.

e) Based on your analysis, state whether the new slogan has helped sales, and give one or two reasons to support your conclusion.

**Solution:(a)**

| Classes | Tally | f | r.f |
|---|---|---|---|
| 1 ____ 2 | 卌 | 5 | 0.25 |
| 3 ____ 4 | 卌 I | 6 | 0.30 |
| 5 ____ 6 | 卌 II | 7 | 0.35 |
| 7 ____ 8 | II | 2 | 0.10 |
| 9 ____ 10 | | 0 | 0 |
| _ | _ | $\sum f$ - 20 | 1 |

(b)

| Classes | Tally | f | r.f |
|---|---|---|---|
| 1 ___ 2 | \|\| | 2 | 0.10 |
| 3 ___ 4 | \|\|\|\| | 4 | 0.20 |
| 5 ___ 6 | ~~\|\|\|\|~~ \| | 6 | 0.30 |
| 7 ___ 8 | ~~\|\|\|\|~~ \| | 6 | 0.30 |
| 9 ___ 10 | \|\| | 2 | 0.10 |
| _ | _ | $\Sigma f - 20$ | 1 |

(c) As the data is discrete, so we use the same classes for both the "before" and "after" responses.

(d) The change (Subtract the "before" response from the "after" response") is

| | | | |
|---|---|---|---|
| -1 | -1 | 1 | 2 |
| 2 | 3 | 5 | 2 |
| 4 | 1 | 2 | -1 |
| 4 | 3 | -4 | 2 |
| 0 | 3 | 2 | 0 |

| Change | Tally | f | r.f |
|---|---|---|---|
| -5 to -4 | \| | 1 | 0.05 |
| -3 to -2 | | 0 | 0 |
| -1 to 0 | ~~\|\|\|\|~~ | 5 | 0.25 |
| 1 to 2 | ~~\|\|\|\|~~ \|\|\| | 8 | 0.40 |
| 3 to 4 | ~~\|\|\|\|~~ | 5 | 0.25 |
| 5 to 6 | \| | 1 | 0.05 |
| _ | _ | $\Sigma f - 20$ | 1 |

(e) The new slogan does not help sales very much.

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**Q2: Before constructing a dam on the Colorado River, the U.S. Army Corps of Engineers performed a series of tests to measure the water flow past the proposed location of the dam. The results of the testing were used to construct the following frequency distribution:**

| River Flow (Thousands of Gallons per Minute | Frequency |
|---|---|
| 1,001-1,050 | 7 |
| 1,051-1,100 | 21 |
| 1,101-1,150 | 32 |
| 1,151-1,200 | 49 |
| 1,201-1,250 | 58 |
| 1,251-1,300 | 41 |
| 1,301-1,350 | 27 |
| 1,351-1,400 | 11 |
| Total | 246 |

(a) Use the data given in the table to construct a "more-than" cumulative frequency distribution and ogive.

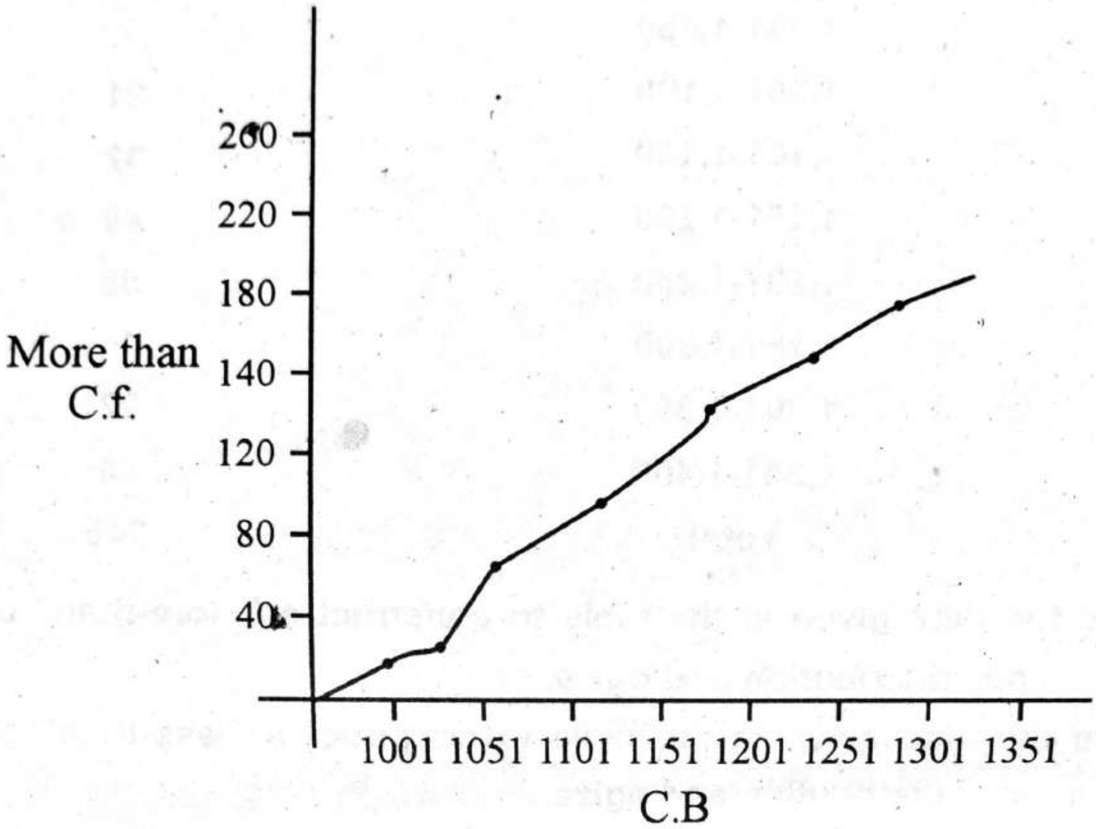
(b) Use the data given in the table to construct a "less-than" cumulative frequency distribution and ogive.

(c) Use your ogive to estimate what proportion of the flow occurs at less than 1,300 thousands of gallons per minute.

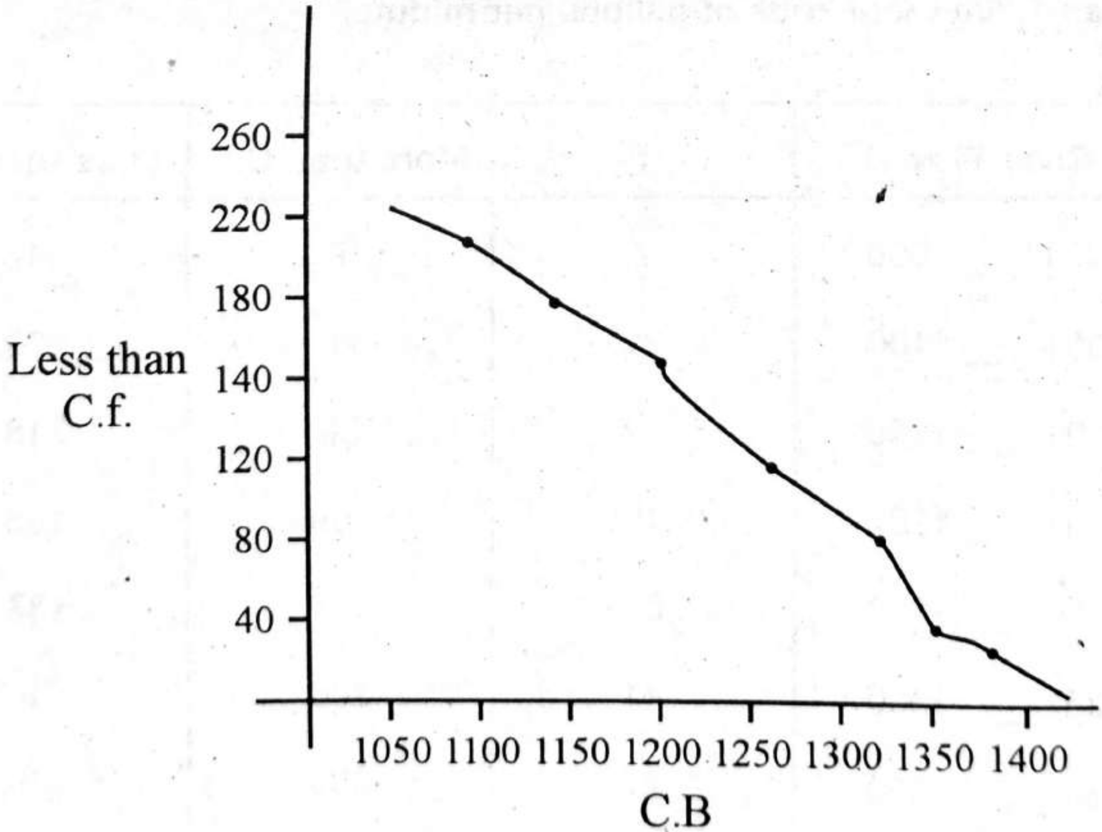
**Solution:**

| River Flow | f | More than C.F | Less than C.F |
|---|---|---|---|
| 1001 ___ 1050 | 7 | 7 | 246 |
| 1051 ___ 1100 | 21 | 28 | 239 |
| 1101 ___ 1150 | 32 | 60 | 218 |
| 1151 ___ 1200 | 49 | 109 | 186 |
| 1201 ___ 1250 | 58 | 167 | 137 |
| 1251 ___ 1300 | 41 | 208 | 79 |
| 1301 ___ 1350 | 27 | 235 | 38 |
| 1351 ___ 1400 | 11 | 246 | 11 |
| _ | $\sum f = 246$ | _ | _ |

(a)




(b)




**c) Proportion of flow occurs at less than 1300 thousands of gallons per minute**

$$\ldots\ldots\ldots = \frac{38}{246}\times 100 \quad (27+11=38)=15.45\%$$

**Q2.1: Pamela Mason, a consultant for a small local brokerage firm, was attempting to design investment programs attractive to senior citizens. She knew that if potential customers could obtain a certain level of return, they would be willing to risk an investment, but below a certain level, they would be reluctant. From a group of 50 subjects, she obtained the following data regarding the various levels of return required for each subject to invest $1,000:**

| Indifference Point | Frequency | Indifference Point | Frequency |
|---|---|---|---|
| $70-74 | 2 | $90-94 | 11 |
| 75-79 | 5 | 95-99 | 3 |
| 80-84 | 10 | 100-104 | 3 |
| 85-89 | 14 | 105-109 | 2 |

**(a) Construct both "more-than" and "less-than" cumulative relative frequency distributions.**

**(b) Graph the 2 distributions in part (a) into relative frequency ogives.**

**Solution:**

| Classes | f | More than c.f | Less than c.f |
|---|---|---|---|
| 70 ____ 74 | 2 | 2 | 50 |
| 75 ____ 79 | 5 | 7 | 48 |
| 80 ____ 84 | 10 | 17 | 43 |
| 85 ____ 89 | 14 | 31 | 33 |
| 90 ____ 94 | 11 | 42 | 19 |
| 95 ____ 99 | 3 | 45 | 8 |
| 100 ____ 104 | 3 | 58 | 5 |
| 105 ____ 109 | 2 | 50 | 2 |
| — | 50 | — | — |

**Q2.2: At a newspaper office, the time required to set the entire front page in type was recorded for 50 days. The data, to the nearest tenth of a minute, are given below.**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 20.8 | 22.8 | 21.9 | 22.0 | 20.7 | 20.9 | 25.0 | 22.2 | 22.8 | 20.1 |
| 25.3 | 20.7 | 22.5 | 21.2 | 23.8 | 23.3 | 20.9 | 22.9 | 23.5 | 19.5 |
| 23.7 | 20.3 | 23.6 | 19.0 | 25.1 | 25.0 | 19.5 | 24.1 | 24.2 | 21.8 |
| 21.3 | 21.5 | 23.1 | 19.9 | 24.2 | 24.1 | 19.8 | 23.9 | 22.8 | 23.9 |
| 19.7 | 12.4 | 23.8 | 20.7 | 23.8 | 24.3 | 21.1 | 20.9 | 21.6 | 22.7 |

**(a) Arrange the data in an array from lowest to highest.**

**(b) Construct a frequency distribution and a "less-than" cumulative frequency distribution from the data, using intervals of 0.8 minute.**

**(c) Construct a frequency polygon from the data.**

**(d) Construct a "less-than" ogive from the data.**

**(e) From your ogive, estimate what percentage of the time the front page can be set in less than 24 minutes.**

**Solution:(a)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 19.0 | 19.5 | 19.5 | 19.7 | 19.8 | 19.9 | 20.1 | 20.3 | 20.7 | 20.7 | 20.7 |
| 20.8 | 20.8 | 20.9 | 20.9 | 21.1 | 21.2 | 21.3 | 21.5 | 21.6 | 21.8 | 21.9 |
| 22.2 | 22.2 | 22.5 | 22.7 | 22.8 | 22.8 | 22.8 | 22.9 | 23.1 | 23.3 | 23.5 |
| 23.6 | 23.7 | 23.8 | 23.8 | 23.8 | 23.9 | 23.9 | 24.1 | 24.1 | 24.2 | 24.2 |
| 24.2 | 24.3 | 25.0 | 25.0 | 25.1 | 25.3 | | | | | |

**(b), (c), (d):**

| Classes | Tally | f | Less than c.f |
|---|---|---|---|
| 19.0 ____ 19.7 | \|\|\|\| | 4 | 50 |
| 19.8 ____ 20.7 | ~~\|\|\|\|~~ \|\| | 7 | 46 |
| 20.8 ____ 21.3 | ~~\|\|\|\|~~ \|\| | 7 | 37 |
| 21.1 ____ 22.1 | ~~\|\|\|\|~~ | 5 | 32 |
| 22.2 ____ 22.9 | ~~\|\|\|\|~~ \|\| | 7 | 27 |
| 23.0 ____ 23.7 | ~~\|\|\|\|~~ | 5 | 20 |
| 23.8 ____ 24.5 | ~~\|\|\|\|~~ ~~\|\|\|\|~~ \| | 11 | 15 |
| 24.6 ____ 25.3 | \|\|\|\| | 4 | 4 |
| — | — | 50 | |

(e) Percentage of less than 24 minutes = $\frac{40}{50} \times 100 = 80\%$

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**Q:3 The National Association of Real Estate Sellers has collected these data on a sample of 130 salespeople representing their total commission earnings annually.**

| Earnings | Frequency |
|---|---|
| **$ 5,000 or less** | **5** |
| **$ 5,001-$ 10,000** | **9** |
| **$ 10,001-$ 15,000** | **11** |
| **$ 15,001-$ 20,000** | **33** |

| | |
|---|---|
| $ 20,001-$ 30,000 | 37 |
| $ 30,001-$ 40,000 | 19 |
| $ 40,001-$ 50,000 | 9 |
| $ Over $ 50,000 | 7 |

**Construct an ogive that will help you answer these questions:**

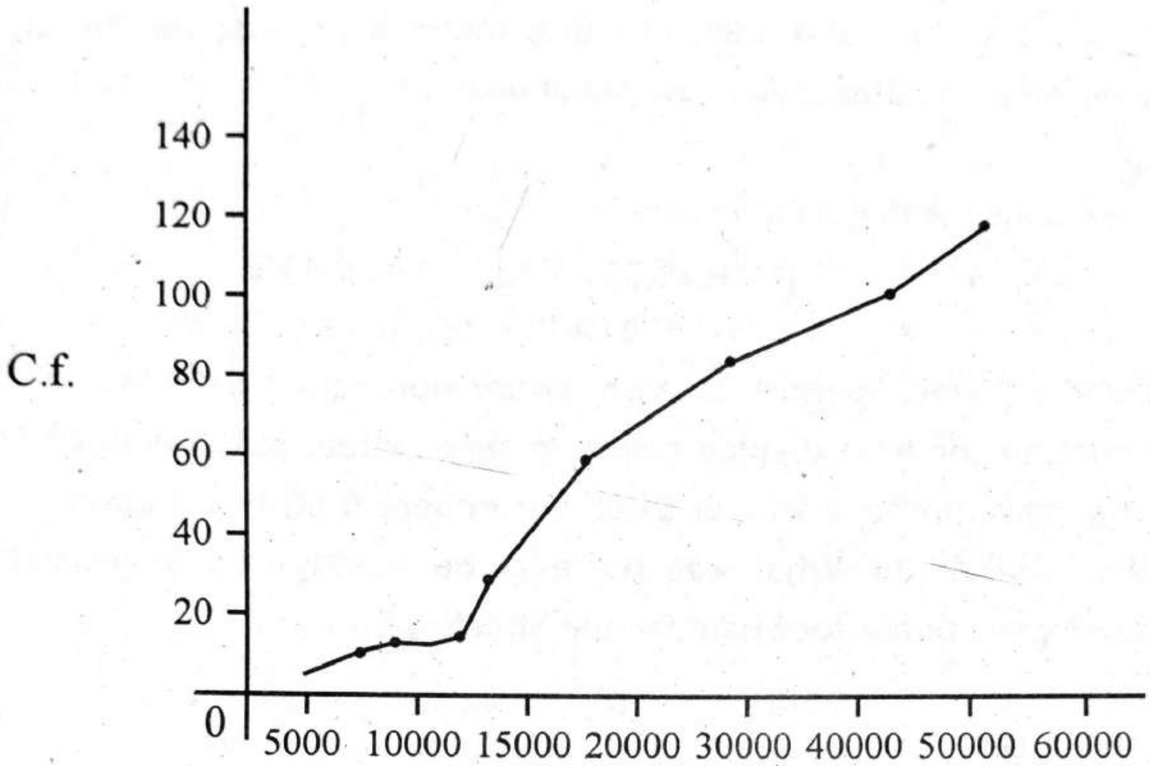
**(a) About what proportion of the salespeople earns more than $25,000?**

**(b) About what does the "middle" salesperson in the sample earn?**

**(c) Approximately how much could a real estate salesperson whose performance was about 25 percent from the top expect to earn annually?**

**Solution:**

| Earnings | f | c.f |
|---|---|---|
| 5,000 or less | 5 | 5 |
| 5,001 _____ 10,000 | 9 | 14 |
| 10,001 _____ 15,000 | 11 | 25 |
| 15,001 _____ 20,000 | 33 | 58 |
| 20,001 _____ 30,000 | 37 | 95 |
| 30,001 _____ 40,000 | 19 | 114 |
| 40,001 _____ 50,000 | 9 | 123 |
| over 50,000 | 7 | 130 |
| — | 130 | — |




(a) $\frac{90}{130} \times 100 = 70\%$ (Approx)

(b) 20000 (Appprox)

(c) 40000 (Approx)

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**Q4: The Birch Company, a manufacturer of electrical circuit boards, has manufactured the the following number of units over the past 5 years:**

| 1992 | 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|
| 12,500 | 13,250 | 14,310 | 15,741 | 17,630 |

**Calculate the average percentage increase in units produced over this time period, and use this to estimate production for 1999.**

**Solution:**

$$\text{G.M.} = \left[0.11 \times 0.09 \times 0.07 \times 0.08 \times (-0.04) \times 0.14 \times 0.11 \times (-0.03) \times 0.06\right]^{\frac{1}{9}}$$
$$= 0.07$$

**Q4.1: Bob Headen is calculating the average growth factor for his stereo store over the last 6 years. Using a geometric mean, he comes up with an answer of 1.24. Individual growth factors for the first 5 years were 1.19,**

**1.35, 1.23, 1.19, and 1.30, but Bob lost the records for the sixth year, after he calculated the mean. What was it?**

**Solution:**

Geometric mean of first 5 years is

$$G.M. = (1.19 \times 1.35 \times 1.23 \times 1.19 \times 1.30)^{\frac{1}{5}}$$

$$= 1.25 \quad \text{The Sixth year's value} = 1.18$$

**Q4.2: Over a 3-week period, a store owner purchased \$120 worth of acrylic sheeting for new display cases in three equal purchases of \$40 each. The first purchase was at \$1.00 per square foot; the second, \$1.10; and the third, \$1.15. What was the average weekly rate of increase in the price per square foot paid for the sheeting?**

**Solution:**

$$G.M. = (1.00 \times 1.10 \times 1.15)^{\frac{1}{3}} = \$1.08$$

**Q4.3: Lisa's Quick Stop has been attracting customers by *selling milk at a* price 2 percent below that of the main grocery store in town. Given below are Lisa's pricses for a gallon of milk for a 2-month period. What was the average rate of change in price at Lisa's Quick Stop?**

| Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 |
|---|---|---|---|---|---|---|---|
| \$2.30 | \$2.42 | \$2.36 | \$2.49 | \$2.24 | \$2.36 | \$2.42 | \$2.49 |

**Solution:**

$$G.M. = (2.30 \times 2.42 \times 2.36 \times 2.49 \times 2.24 \times 2.36 \times 2.42 \times 2.49)^{\frac{1}{8}}$$

$$= 2.38$$

**Q5:(A) For the following frequncy distribution.**

**(a) Which number item represents the median?**

**(b) Which class contains the median?**

**(c) What is the width of the equal steps in the median class?**

**(d) What is the estimated value of the median for these data?**

**(e) Use Equation 3-8 to estimate the median for the data. Are your two estimates close to one another?**

| Class | Frequency |
|---|---|
| 10-19.5 | 8 |
| 20-29.5 | 15 |
| 30-39.5 | 23 |
| 40-49.5 | 37 |
| 50-59.5 | 46 |

| Class | Frequency |
|---|---|
| 60-69.5 | 52 |
| 70-79.5 | 84 |
| 80-89.5 | 97 |
| 90-99.5 | 16 |
| 100 or over | 5 |

**Solution:**

Median Class

| Classes | f | C.F |
|---|---|---|
| 10 _____ 19.5 | 8 | 8 |
| 20 _____ 29.5 | 15 | 23 |
| 30 _____ 39.5 | 23 | 46 |
| 40 _____ 49.5 | 37 | 83 |
| 50 _____ 59.5 | 46 | 129 |
| 60 _____ 69.5 | 52 | 181 |
| 70 _____ 79.5 | 84 | 265 |
| 80 _____ 89.5 | 97 | 362 |
| 90 _____ 99.5 | 16 | 378 |
| 100 _____ 109.5 | 5 | 383 |
| — | $\sum f = 383$ | — |

(a) $\frac{n}{2} = \frac{383}{2} = 191.5$

(b) $70 - 79.5$

(c) 10

(d) About 59.75

(e) Median $= \ell + \frac{h}{f}\left(\frac{n}{2} - c\right)$

Here $\frac{n}{2} = \frac{383}{2} = 191.5, \ell = 70, h = 10, f = 84, c = 181$

Median $= 70 + \frac{10}{84}(191.5 - 181)$

$= 70 + \frac{10}{84}(10.5)$

$= 70 + 1.25$

$= 71.25$

**(B): Estimate the mode for the distribution given in Exercise 3-36.**

**Solution:**

| Classes | f |
|---|---|
| Less than 250 | 52 |
| 250 ____ 499.99 | 337 |
| 500 ____ 749.99 | 1066 $f_1$ |
| 750 ____ 999.99 | 1776 $f_m$ |
| 1000 and over | 1492 $f_2$ |
| — | 4723 |

Model $= \ell + \frac{(f_m - f_1)}{(f_m - f_1) + (f_m - f_2)} \times h$

$= 750 + \frac{(1776 - 1066)}{(1776 - 1066) + (1776 - 1492)} \times 250$

$= 750 + \frac{710}{710 + 284} \times 250$

$= 750 + 178.57$

$=$ **928.57**

**Q:6 For the sample that follows, compute the**

**(a) Range.**

**(b) Interfractile range between the 20th and 80th percentiles.**

**(c) Interquartile range.**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **2,549** | **3,897** | **3,661** | **2,697** | **2,200** | **3,812** | **2,228** | **3,891** | **2,668** | **2,268** |
| **3,692** | **2,145** | **2,653** | **3,249** | **2,841** | **3,469** | **3,268** | **2,598** | **3,842** | **3,362** |

**Solution:**

2145, 2200, 2268, 2549, 2598, 2653, 2668, 2697, 2841, 3249, 3268, 3362, 3469, 3661, 3692, 3812, 3842, 3891, 3897

(a) $R_{(1)} = 2145, \quad R_{(n)} = 3897$

$$\text{Range} = R_{(n)} - R_{(1)}$$
$$= 3897 - 2145$$
$$= 1752$$

(b)
$$P_{80} = 80\left(\frac{n+1}{100}\right)^{th} \text{ value}$$
$$= 80\left(\frac{20+1}{100}\right)^{th} \text{ value}$$
$$= 16.8^{th}\text{ Value}$$
$$P_{80} = 3692 + (0.8)(3812 - 3692)$$
$$= 3692 + (0.8)(120)$$
$$= 3692 + 96$$
$$= 3788$$
$$P_{20} = 20\left(\frac{n+1}{100}\right)^{th} \text{ Value}$$
$$= 20\left(\frac{20+1}{100}\right)^{th} \text{ Value}$$
$$= 4.2^{th} \text{ value}$$
$$P_{20} = 2268 + (0.2)(2549 - 2268)$$
$$= 2268 + (0.2)\,281$$
$$= 2268 + 56.20$$

$= 2324.20$

In terfractile range between 20th and 80th precentile is

$= P_{80} - P_{20}$

$= 3788 - 2324.20$

$= 1463.80$

(c) $Q_3 = 3\left(\frac{n+1}{4}\right)^{th}$ Value

$= 3\left(\frac{20+1}{4}\right)^{th}$ Value

$= 15.75^{th}$ Value

$Q_3 = 3661 + (0.75)\ (3692 - 3661)$

$= 3661 + (0.75)\ (31)$

$= 3661 + 23.25$

$= 3684.25$

$Q_1 = \left(\frac{n+1}{4}\right)^{th}$ Value

$= \left(\frac{20+1}{4}\right)^{th}$ Value

$= 5.25^{th}$ Value

$Q_1 = 2549 + (0.25)(2598 - 2549)$

$= 2549 + (0.25)(49)$

$= 2549 + 12.25$

$= 2561.25$

Interquartile range $= Q_3 - Q_1$

$= 3684.25 - 2561.25$

$= 1123$

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**Q7: FundInfo provides information to its subcsribers to enable them to evaluate the performance of mutual funds they are considering as**

potential investment vehicles. A recent survey of funds whose stated investment goal was growth and income produced the following data on total annual rate of return over the past five years:

| Annual return (%) | 11.0-11.9 | 12.0-12.9 | 13.0-13.9 | 14.0-14.9 | 15.0-15.9 | 16.0-16.9 | 17.0-17.9 | 18.0-18.9 |
|---|---|---|---|---|---|---|---|---|
| Frequency | 2 | 2 | 8 | 10 | 11 | 8 | 3 | 1 |

(a) Calculate the mean, variance, and standard deviation of the annual rate of return for this sample of 45 funds.

(b) According to Chebyshev's theorem, between what values should at least 75 percent of the sample observations fall? What percentage of the observations actually do fall in that interval?

(c) Because the distribution in roughly bell-shaped, between what values would you expect to find 68 percent of the observations? What percentag of the observations actually do fall in that interval?

**Solution:**

| Classes | f | x | fx | $fx^2$ |
|---|---|---|---|---|
| 110 _____ 11.9 | 2 | 11.45 | 22.90 | 262.205 |
| 12.0 _____ 12.9 | 2 | 12.45 | 24.90 | 310.005 |
| 13.0 _____ 13.9 | 8 | 13.45 | 107.60 | 1447.22 |
| 14.0 _____ 14.9 | 10 | 14.45 | 144.50 | 2088.025 |
| 15.0 _____ 15.9 | 11 | 15.45 | 169.95 | 2625.7275 |
| 16.0 _____ 16.9 | 8 | 16.45 | 131.60 | 2164.82 |
| 17.0 _____ 17.9 | 3 | 17.45 | 52.35 | 913.5075 |
| 18.0 _____ 18.9 | 1 | 18.45 | 18.45 | 340.4025 |
| — | 45 | — | 672.25 | 10151.9125 |

$$\mu = \frac{\Sigma fx}{fx} = \frac{672.25}{45} = 14.94$$

$$S^2 = \frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2 = \frac{10151.9125}{45} - \left(\frac{672.25}{45}\right)^2$$

$$= 225.59 - 223.17 = 2.42$$

$S = \sqrt{2.42} = 1.56$

**Q8: The average commission charged by full-service brokerage firms on a sale of common stock is $144, and the standard deviation is $52. Joel Freelander has taken a random sample of121 trades by his clietns and determined that they paid an average commission of $151. At a 0.10 significance level, can Joel conclude that his clients commissions are higher than the industry average?**

**Solution:**

1) $H_0: \mu \leq 144$

$H_1: \mu > 144$

2) $\alpha = 0.10$

3) Test Statistics

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

4) Calculation:

$\bar{X} = 151, \ \mu = 144, \ \sigma = 52, \ n = 121$

$$Z = \frac{151 - 144}{52/\sqrt{121}} = \frac{7}{4.73} = 1.48$$

5) Critical region:

$Z > 1.645$

6) Conclusion:

Zcal = 1.48 < Ztable = 1.645

∴ Accept Ho:

**Q8.1: Each day, the United States Customs Service has historically intercepted about $28 million in contraband goods being smuggled into the country, with a standard deviation of $16 million per day. On 64 randomly chosen days in 1992, the U.S Customs Service intercepted an average of $30.3 million in contraband goods. Does this sample indicate (at a 5 percent level of significance) that the Customs Commissioner**

**should be concerned that smuggling has increased above its historic level?**

**Solution:**

1) $H_0: \quad \mu \leq 28$

   $H_1: \quad \mu > 28$

2) $\alpha = 0.05$

3) Test Statistc

$$Z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

4) Calculations:

$$\bar{X} = 30.3, \ \mu = 28, \ \sigma = 16, \ n = 64$$

$$Z = \frac{30.3 - 28}{16/\sqrt{64}} = \frac{2.3}{2} = 1.15$$

5) Critical region:

   $Z > 1.645$

6) Conclusion:

   Zcal = 1.15 < Ztable = 1.645

   Accept Ho:

**Q8.2: Before the 1973 oil embargo and subsequent increases in the price of crude oil, gasoline usage in the Uniter States had gworn at a seasonally adjusted rate of 0.57 percent per month, with a standard deviation of 0.10 percent per month. In 15 randomly chosen months between 1975 and 1985, gasoline usage grew at an average rate of only 0.33 percent per month. At a 0.01 level of significance, can you conclude that the growth in the use of gasoline had decreased as a result of the embargo and its consequences?**

**Solution:**

1) $H_0: \quad \mu \geq 0.57$

   $H_1: \quad \mu < 0.57$

2) $\alpha = 0.01$

3) Test Statistc

$$Z = \frac{\overline{X} - \mu}{\sigma / \sqrt{n}}$$

4) Calculations:

$\overline{X} = 0.33,\ \mu = 0.57,\ \sigma = 0.10,\ n = 15$

$$Z = \frac{0.33 - 0.57}{15 / \sqrt{0.10}} = \frac{-0.24}{47.43} = -0.005$$

5) Critical region:

$Z > -1.645$

6) Conclusion:

Zcal = -0.005 > Ztable = -1.645

- Accept Ho:

---

**Q9: Feronetics specializes in the use of gene-splicing *techniques to* produce new pharmaceutical compounds. It has recently developed a nasal spray containing interferon, which it believes will limit the transmission of the common cold within families. In the general population, 15.1 percent of all individuals will catch a rhinovirus -caused cold once another family member contracts such a cold. The interferon spray was tested on 180 hpeople, one of whose family members subsequently contracted a rhinovirus -caused cold. Only 17 of the test subj- ects developed similar colds.**

**(a) At a significance level of 0.05, should Feronetics conclude that the new spray effectively reduces transmission of colds?**

**(b) What should it conclude at $\alpha$ =0.02?**

**(c) On the basis of these results, do you think Feronetics should be allowed to market thenew spray? Explain.**

**Solution:**

1) $H_0: \quad P = 0.19$

$H_1: \quad P \neq 0.19$

2) $\prec = 0.04$

3) Test Statistics

$$Z = \frac{\bar{P} - P}{\sigma_{\bar{P}}}$$

4) Calculations:

$P = 0.19,\ q = 1 - p = 1 - 0.19 \ldots\ldots$

$\ldots\ldots = 0.81,\ n = 85$

$\bar{P} = 0.1412$

$$\sigma_{\bar{P}} = \sqrt{\frac{pq}{n}} \quad = \sqrt{\frac{(0.19)(0.81)}{85}} = 0.0414$$

$$Z = \frac{0.1412 - 0.19}{0.0414} = -1.18$$

5) Critical region:

$Z < -2.06$ or $Z > 2.06$

6) Conclusion:

Zcal = 1.18 < Ztab = -2.06

Accept Ho:

**Q9.1: Some financial theoreticians believe that the stock market's daily prices constitute a "random walk with positive drift." If this is accrate, then the Dow Jones Industrial Average should show a gain on more than 50 percent of all trading days. If the average increased on 101 of 175 randomly chosen days, what do you think about the suggested theory? Use a 0.01 level of significance.**

**Solution:**

1) $H_0: \quad P = 0.19$

$H_1: \quad P \neq 0.19$

2) $\alpha = 0.04$

3) Test Statistics

$$Z = \frac{\bar{P} - P}{\sigma_{\bar{P}}}$$

4) Calculations:

$P = 0.19,\ q = 1 - p = 1 - 0.19 \ldots\ldots$

$\ldots\ldots = 0.81,\ n = 85$

$\bar{P} = 0.1412$

$$\sigma_{\bar{P}} = \sqrt{\frac{pq}{n}} \quad = \sqrt{\frac{(0.19)(0.81)}{85}} = 0.0414$$

$$Z = \frac{0.1412 - 0.19}{0.0414} = -1.18$$

5) Critical region:

$Z < -2.06$ or $Z > 2.06$

6) Conclusion:

Zcal = 1.18 < Ztab = -2.06

Accept Ho:

**Q9.2: MacroSwift estimated last year that 35 percent of potential software buyers were planning to wait to purchase the new operating system, Window Panes, until an upgrade had been released. After in advertising campaign to reassure the public, MacroSwift surveyed 3,000 people and found 950 who were still skeptical. At the 5 percent significance level, can the comapany conclude the proportion of skeptical people has decreased?**

**Solution:**

1) $H_0: \quad P = 0.39$

$H_1: \quad P \neq 0.39$

2) $\prec = 0.02$

3) Test Statistic

$$Z = \frac{\overline{P} - P}{\sigma_{\overline{P}}}$$

4) Calculations:

$P = 0.39, \; q = 1 - p = 1 - 0.39$ ......

...... $= 0.61, \; n = 350$

$\overline{P} = 0.41$

$$\sigma_{\overline{P}} = \sqrt{\frac{pq}{n}} = \sqrt{\frac{(0.39)(0.61)}{350}} = 0.025$$

$$Z = \frac{\overline{P} - P}{\sigma_{\overline{p}}} = \frac{0.41 - 0.39}{0.025} = 0.80$$

5) Critical region:

$Z < -1.65$ or $Z > 1.65$

6) Conclusion:

Zcal = 0.80 < Ztab = 1.65

Accept Ho:

**Q9.3: Rick Douglas, the new manager of Food Barn, is interested in the percentage of customers who are totally satisfied with the store. The previous manager had 86 percent of the customers totally satisfied, and Rack claims the same in true today. Rick sampled 187 customers and found 157 were totally satisfied. At the 1 percent significance level, is there evidence that Rick's claim is valid?**

**Solution:**

1) $H_0$: $P = 0.86$

$H_1$: $P \neq 0.86$

2) $\alpha = 0.01$

3) Test Statistic

$$Z = \frac{\bar{P} - P}{\sigma_{\bar{P}}}$$

4) Calculations:

$P = 0.86, \; q = 1 - p = 1 - 0.86$ ......

...... $= 0.14, \; n = 187, \; X = 157$

$$\bar{P} = \frac{x}{n} = \frac{157}{187} = 0.84$$

$$\sigma_{\bar{P}} = \sqrt{\frac{pq}{n}} = \sqrt{\frac{(0.86)(0.14)}{187}} = 0.0254$$

$$Z = \frac{\bar{P} - P}{\sigma_{\bar{P}}} = \frac{0.84 - 0.86}{0.0254} = 0.79$$

5) Critical region:

Z < -2.58 or Z > 2.58

6) Conclusion:

Zcal = -0.79 < Ztable = -2.58

Accept Ho:

---

**Q10: Realtor Elaine snyderman took a random sample of 12 homes in a prestigious suburb of Chicago and found the average appraised market value to be $780,000, and the standard deviation was $49,000. Test the**

**hypothesis that for all homes in the area, the mean appraised value is \$825,000 against the alternative that it is less than \$825,000. Use the 0.05 level of significance.**

**Solution:**

1) $H_0: \quad \mu > 825000$

$H_1: \quad \mu < 825000$

2) $\alpha = 0.05$

3) Test Statistic

$$t = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

4) Calculations:

$\bar{X} = 780000, \ \hat{\sigma} = 49000,$ .........

..$\mu = 825000, n = 11$

$$T = \frac{780000 - 825000}{49000/\sqrt{12}} = \frac{-45000}{14145.08}...$$

...... $= -3.18$

5) Critical region:

$t_{(\alpha, V=n-1)} = t_{(0.05, V=12-1=11)}$

6) Conclusion:

$t < -1.796$

$t_{cal} = -3.18 < T_{table} = 1.796$

Reject Ho:

**Q10.1: For a sample of 60 women taken from a population of over 5,000 enrolled in a weight-raducing program at a nationwide chain of health spas, the sample mean diastolic blood pressure is 101 and the sample standard deviation is 42. At a significance level of 0.02, on average, did the women entolled in the program have diastolic blood pressure that exceeds the value of 75?**

**Solution:**

1) $H_0: \quad \mu > 825000$

$H_1: \quad \mu < 825000$

2) $\alpha = 0.05$

3) Test Statistic

$$t = \frac{\overline{X} - \mu}{\sigma / \sqrt{n}}$$

4) Calculations:

$\overline{X} = 780000$, $\hat{\sigma} = 49000$, .........

..$\mu = 825000$, $n = 11$

$$T = \frac{780000 - 825000}{49000/\sqrt{12}} = \frac{-45000}{14145.08}...$$

...... $= -3.18$

5) Critical region:

$t_{(\alpha, v=n-1)} = t_{(0.05, V=12-1=11)}$

6) Conclusion:

$t < -1.796$

$t_{cal} = -3.18 < T_{table} = 1.796$

Reject Ho:

---

**Q11: A credit-insurance organization has developed a new high-tech method of training new sales personnel. The company sampled 16 employees who were trained the original way and found average daily sales to be \$688 and the sample standard deviation was \$32.63. They also sampled 11 employees who were trained using the new method and found average daily sales to be \$706 and the sample standard deviation was \$24.84. At a=0.05, can the company conclude that average dialy sales have in creased under the new plan?**

**Solution:**

1) $H_0 : \mu_1 \geq \mu_2$ or $H_0 : \mu_1 - \mu_2 \geq 0$

$H_1 : \mu_1 < \mu_2$ $H_1 : \mu_1 - \mu_2 < 0$

2) $\alpha = 0.05$

3) Test Statistics

$$t = \frac{(\overline{X}_1 - \overline{X}_2) - (\mu_1 - \mu_2)}{\hat{\sigma}_{\overline{X}_1 - \overline{X}_2}}$$

4) Calculations:

$n_1 = 16, \quad \bar{X}_1 = 688, \quad S_1 = 32.63$

$n_2 = 11, \quad \bar{X}_2 = 706, \quad S_2 = 24.84$

$S^2P =$

$$\frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_2-2} = \frac{(16-1)(32.63)^2+(11-1)(24.84)^2}{16+11-2}$$

$$S^2P = \frac{22141.0095}{25} = 885.64038$$

$$Sp = \sqrt{885.64038} = 29.76$$

$$\hat{\sigma}_{\bar{X}_1-\bar{X}_2} = Sp\sqrt{\frac{1}{n_1}+\frac{1}{n_2}} = (29.76)\sqrt{\frac{1}{16}+\frac{1}{11}}$$

$$= (29.76)(0.3917) = 11.66$$

$$t = \frac{(688-706)-0}{11.66} = -1.54$$

5) Critical Region:

$$t_{(\alpha, v=n_1+n_2-2)} = t_{(0.05, v=25)} = -1.708$$

$t < -1.708$

6) Conclusion:

$$t_{cal} = -1.54 > t_{table} = -1.708$$

Accept Ho

**Q11.1: A large stock-brokerage firm wants to determine how successful its new account executives have been at recruiting clients. After completing their training, new account execs spend several weeks calling prospective clients, trying to get the prospects to open accounts with the firm. The following data give the numbers of new accounts opened in their first 2 weeks by 10 randomly chosen female accounts exces and by 8 randomly chosen male account execs. At a=0.05, does it appear that the women are more effective at generating new accounts than the men are?**

**Number of New Accounts**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Female account execs** | 12 | 11 | 14 | 13 | 13 | 14 | 13 | 12 | 14 | 12 |
| **Male account execs** | 13 | 10 | 11 | 12 | 13 | 12 | 10 | 12 | | |

**Solution:**

1) $H_0 : \mu_1 \geq \mu_2$ or $H_0 : \mu_1 - \mu_2 \geq 0$

$H_1 : \mu_1 < \mu_2$ $H_1 : \mu_1 - \mu_2 < 0$

2) $\alpha = 0.05$

3) Test Statistics

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\hat{\sigma}_{\bar{X}_1 - \bar{X}_2}}$$

4) Calculations:

$n_1 = 16, \quad \bar{X}_1 = 688, \quad S_1 = 32.63$

$n_2 = 11, \quad \bar{X}_2 = 706, \quad S_2 = 24.84$

$S^2P =$

$$\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2} = \frac{(16-1)(32.63)^2 + (11-1)(24.84)^2}{16+11-2}$$

$$S^2P = \frac{22141.0095}{25} = 885.64038$$

$$Sp = \sqrt{885.64038} = 29.76$$

$$\hat{\sigma}_{\bar{X}_1 - \bar{X}_2} = Sp\sqrt{\frac{1}{n_1} + \frac{1}{n_2}} = (29.76)\sqrt{\frac{1}{16} + \frac{1}{11}}$$

$$= (29.76)(0.3917) = 11.66$$

$$t = \frac{(688 - 706) - 0}{11.66} = -1.54$$

5) Critical Region:

$t_{(\alpha, v = n_1 + n_2 - 2)} = t_{(0.05. v=25)} = -1.708$

$t < -1.708$

6) Conclusion:

$t_{cal} = -1.54 > t_{table} = -1.708$

Accept Ho

**Q11.2: To celebrate their first anniversary, Randy Nelson decided to buy a pair of diamond earnings for his wife Debble. He was shown nine pairs with marquise gems weighing approximately 2 carats per pair. Because of differences in the colors and qualities of the stones, the prices varied**

**from set to set. The average price was $2,290, and the sample standard deviation was $370. He also looked at six pairs with pear-shaped stones of the same 2-carat approximate weight. These earnings had an average price of $3,065, and the standard deviation was $805. On the basis of this evidence, can Randy conclude (at a significance level of 0.05) that pear-shaped diamonds cost more, on average, than marquise diamonds?**

**Solution:**

1) $H_0 : \mu_1 \geq \mu_2$ or $H_0 : \mu_1 - \mu_2 \geq 0$

$H_1 : \mu_1 < \mu_2$ $\quad$ $H_1 : \mu_1 - \mu_2 < 0$

2) $\alpha = 0.05$

3) Test Statistics

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\hat{\sigma}_{\bar{X}_1 - \bar{X}_2}}$$

4) Calculations:

$n_1 = 9, \quad \bar{X}_1 = 2990, \quad S_1 = 370$

$n_2 = 6, \quad \bar{X}_2 = 3065, \quad S_2 = 805$

$$S^2P = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2} = \frac{(9-1)(370)^2 + (6-1)(805)^2}{9+6-2}$$

$$S^2P = \frac{4335.325}{13} = 333486.54$$

$$Sp = 577.48$$

$$\hat{\sigma}_{\bar{X}_1 - \bar{X}_2} = Sp\sqrt{\frac{1}{n_1} + \frac{1}{n_2}} = (577.48)\sqrt{\frac{1}{9} + \frac{1}{6}} = 304.36$$

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\hat{\sigma}_{\bar{X}_1 - \bar{X}_2}} = \frac{(2990 - 3065) - 0}{304.36} = -0.25$$

5) Critical Region:

$$t_{(\alpha, v = n_1 + n_2 - 2)} = t_{(0.05, v=13)} = -1.771$$

$t < -1.771$

6) Conclusion:

records for the sixth year,

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e your



$t_{cal} = -0.25 \quad > \quad t_{table} = -1.771$

Accept Ho

**Q11.3: A sample of 30-year conventional mortgage rates at 11 randomly chosen banks in California yielded a mean rate of 7.61 percent and a standard deviation of 0.39 percent. A similar sample taken at 8 randomly chosen banks in Pennsylvania had a mean rate of 7.43 percent, and a standard deviation of 0.56 percent. Do these samples provide evidence to conclude (at a = 0.10) that conventional mortgage rates in California and Pennsylvania come from populations with different means?**

**Solution:**

1) $H_0 : \mu_1 \geq \mu_2$ or $H_0 : \mu_1 - \mu_2 \geq 0$

$H_1 : \mu_1 < \mu_2$ $\quad H_1 : \mu_1 - \mu_2 < 0$

2) $\alpha = 0.05$

3) Test Statistics

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\hat{\sigma}_{\bar{X}_1 - \bar{X}_2}}$$

4) Calculations:

$n_1 = 9, \quad \bar{X}_1 = 2990, \quad S_1 = 370$

$n_2 = 6, \quad \bar{X}_2 = 3065, \quad S_2 = 805$

$$S^2P = \frac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{n_1+n_2-2} = \frac{(9-1)(370)^2 + (6-1)(805)^2}{9+6-2}$$

$$S^2P = \frac{4335.325}{13} = 333486.54$$

$$Sp = 577.48$$

$$\hat{\sigma}_{\bar{X}_1 - \bar{X}_2} = Sp\sqrt{\frac{1}{n_1} + \frac{1}{n_2}} = (577.48)\sqrt{\frac{1}{9} + \frac{1}{6}} = 304.36$$

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\hat{\sigma}_{\bar{X}_1 - \bar{X}_2}} = \frac{(2990 - 3065) - 0}{304.36} = -0.25$$

$t_{cal} = -0.25 \quad > \quad t_{table} = -1.771$

Accept Ho

**Q11.3: A sample of 30-year conventional mortgage rates at 11 randomly chosen banks in California yielded a mean rate of 7.61 percent and a standard deviation of 0.39 percent. A similar sample taken at 8 randomly chosen banks in Pennsylvania had a mean rate of 7.43 percent, and a standard deviation of 0.56 percent. Do these samples provide evidence to conclude (at a = 0.10) that conventional mortgage rates in California and Pennsylvania come from populations with different means?**

**Solution:**

1) $H_0 : \mu_1 \geq \mu_2$ or $H_0 : \mu_1 - \mu_2 \geq 0$

$H_1 : \mu_1 < \mu_2$ $H_1 : \mu_1 - \mu_2 < 0$

2) $\alpha = 0.05$

3) Test Statistics

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\hat{\sigma}_{\bar{X}_1 - \bar{X}_2}}$$

4) Calculations:

$n_1 = 9, \quad \bar{X}_1 = 2990, \quad S_1 = 370$

$n_2 = 6, \quad \bar{X}_2 = 3065, \quad S_2 = 805$

$$S^2P = \frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2} = \frac{(9-1)(370)^2 + (6-1)(805)^2}{9+6-2}$$

$$S^2P = \frac{4335.325}{13} = 333486.54$$

$$Sp = 577.48$$

$$\hat{\sigma}_{\bar{X}_1 - \bar{X}_2} = Sp\sqrt{\frac{1}{n_1} + \frac{1}{n_2}} = (577.48)\sqrt{\frac{1}{9} + \frac{1}{6}} = 304.36$$

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\hat{\sigma}_{\bar{X}_1 - \bar{X}_2}} = \frac{(2990 - 3065) - 0}{304.36} = -0.25$$

5) Critical Region:

$$t_{(\alpha, v=n_1+n_2-2)} = t_{(0.05, v=13)} = -1.771$$

$t < -1.771$

6) Conclusion:

$$t_{cal} = -0.25 > t_{table} = -1.771$$

Accept Ho

---

**Q12: For the following data**

**(a) Plot the scatter diagram.**

**(b) Develop the estimating equation that best describes the data.**

**(c) Predict Y for X = 6,13.4, 20.5**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| X | 2.7 | 4.8 | 5.6 | 18.4 | 19.6 | 21.5 | 18.7 | 14.3 |
| Y | 16.66 | 16.92 | 22.3 | 71.8 | 80.88 | 81.4 | 77.46 | 48.7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| X | 11.6 | 10.9 | 18.4 | 19.7 | 12.3 | 6.8 | 13.8 |
| Y | 50.48 | 47.82 | 71.5 | 81.26 | 50.1 | 39.4 | 52.8 |

**Solution:**

**(a) Do it yourself**

**(b) The estimated equation is**

$$y = a + bx$$

Where

$$b = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{n\Sigma x^2 - (\Sigma x)^2}$$

$$a = \frac{\Sigma y - b\Sigma x}{n}$$

| X | Y | $X^2$ | XY |
|---|---|---|---|
| 2.7 | 16.66 | 7.29 | 44.982 |
| 4.8 | 16.92 | 23.04 | 81.216 |
| 5.6 | 22.30 | 31.36 | 124.880 |
| 18.4 | 71.80 | 338.56 | 90.200 |
| 19.6 | 80.88 | 384.16 | 1585.248 |
| 21.5 | 81.40 | 462.25 | 1750.100 |
| 18.7 | 77.46 | 349.69 | 1448.502 |
| 14.3 | 48.70 | 204.49 | 696.410 |
| 11.6 | 50.48 | 134.56 | 585.568 |
| 10.9 | 47.82 | 118.81 | 521.238 |
| 18.4 | 71.50 | 338.56 | 1315.600 |
| 19.7 | 81.26 | 388.09 | 1600.822 |
| 12.3 | 50.10 | 151.29 | 616.230 |
| 6.8 | 39.40 | 46.24 | 267.920 |
| 13.8 | 52.80 | 190.44 | 728.640 |
| 199.1 | 809.48 | 3168.83 | 11457.556 |

$$b = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{n\Sigma x^2 - (\Sigma x)^2} = \frac{(15)(11457.556) - (199.1)(809.48)}{(15)(3168.83) - (199.1)}$$

$$= \frac{10695.872}{7891.640} = 1.36$$

$$a = \frac{\Sigma y - b\Sigma x}{n} = \frac{809.48 - (1.36)(199.1)}{15} = 35.91$$

**The esimated equation is**

$y = 35.91 + 1.36\ X$

(c) $y = 35.91 + 1.36(6) = 44.07$

$y = 35.91 + 1.36\ (13.4) = 54.134$

$y = 35.91 + 1.36\ (20.5) = 63.79$

**Q13: The city council of Bowie, Maryland, has gathered data on the number of minor traffic accidents and the number of youth soccer games that occur in town over a weekend.**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **X(Soccer games)** | **20** | **30** | **10** | **12** | **15** | **25** | **34** |
| **Y(minor accidents)** | **6** | **9** | **4** | **5** | **7** | **8** | **9** |

**(a) Plot these data.**

**(b) Develop the estimating equation that best describes these data.**

**(c) Predict the number of minor traffic accidents that will occur on a weekend during which 33 soccer games take place in Bowie.**

**(d) Calculate the standard error of estimate.**

**Solution:**

(a) plot the data on graph yourself

| X | Y | X2 | XY | Y2 |
|---|---|---|---|---|
| 20 | 6 | 400 | 120 | 36 |
| 30 | 9 | 900 | 270 | 81 |
| 10 | 4 | 100 | 40 | 16 |
| 12 | 5 | 144 | 60 | 25 |
| 15 | 7 | 225 | 105 | 49 |
| 25 | 8 | 625 | 200 | 64 |
| 34 | 9 | 1156 | 306 | 81 |
| 146 | 48 | 3550 | 1101 | 352 |

(b) The estimated equation is

$$y = a + bx$$

$$\text{Where } b = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{n\Sigma x^2 - (\Sigma x)^2} = \frac{(7)(1101) - (164)(48)}{(7)(3550) - (146)^2}$$

$$= \frac{699}{3534} - 0.20$$

$$a = \frac{\Sigma y - b\Sigma x}{n} = \frac{48 - (0.20)(146)}{7} = 2.69$$

**The estimated equation is**

$$y = 2.69 + 0.20\,x$$

c) $y = 2.69 + 0.20\,(33) = 9.29$

d) $$Se = \sqrt{\frac{\Sigma y^2 - a\Sigma y - b\Sigma xy}{n-2}} = \sqrt{\frac{352 - (2.69)(48) - (0.20)(1101)}{7-2}}$$

$$= \sqrt{\frac{2.68}{5}} = 0.73$$

---

**Q14: Bank of Lincoln is interested in reducing the amount of time people spend waiting to see a personal banker. The bank is interested in the relationship between waiting time (Y) in minutes and number of bankers on duty (X). Customers were randomly selected with the data given below:**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| X | 2 | 3 | 5 | 4 | 2 | 6 | 1 | 3 | 4 | 3 | 3 | 2 | 4 |
| Y | 12.8 | 11.3 | 3.2 | 6.4 | 11.6 | 3.2 | 8.7 | 10.5 | 8.2 | 11.3 | 9.4 | 12.8 | 8.2 |

**(a) Calculate the regression equation that best fits the data.**

**(b) Calculate the sample coefficient of determination and the sample coefficient of correlation.**

**Solution:**

| X | Y | XY | X2 | Y2 |
|---|---|---|---|---|
| 5.0 | 9 | 45 | 25.00 | 81 |
| 5.5 | 6 | 33 | 30.25 | 36 |
| 6.0 | 3 | 18 | 36.00 | 9 |
| 6.5 | 0 | 0 | 42.25 | 0 |
| 5.0 | 7 | 35 | 25.00 | 49 |
| 28.0 | 25 | 131 | 158.50 | 175 |

Coefficient of Determination

$$r^2 = \frac{a\Sigma y + b\Sigma xy - n\overline{Y}^2}{\Sigma y^2 - n\overline{y}^2}$$

Where $b = \dfrac{N\Sigma xy - (\Sigma x)(\Sigma y)}{n\Sigma x^2 - (\Sigma x)^2} = \dfrac{(5)(131) - (28)(25)}{(5)(158.50) - (28)^2} = \dfrac{-45}{8.5} = -5.29$

$$a = \frac{\Sigma y - b\Sigma x}{n} = \frac{25 - (-5.29)(28.0)}{5} = 34.62$$

$$\overline{Y} = \frac{\Sigma y}{n} = \frac{25}{5} = 5$$

$$r^2 = \frac{(34.62)(25) + (-5.29)(131) - (5)(5)^2}{75 - (5)(5)^2} = \frac{47.51}{50} = 0.95$$

Now $r = \dfrac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{\left[n\Sigma x^2 - (\Sigma x)^2\right]\left[n\Sigma y^2 - (\Sigma y)^2\right]}}$

$$= \frac{(5)(131) - (28)(25)}{\sqrt{\left[(5)(158.50) - (28)^2\right]\left[(5)(175) - (25)^2\right]}}$$

$$= \frac{-45}{\sqrt{(8.5)(250)}} = \frac{-45}{46.0977} = -0.98$$

**Q14.1: Zippy Cola is studying the effect of its latest advertising campaign. People chosen at random were called and asked how many cansof Zippy Cola They had bought in the past week and how many Zippy Cola advertisements they had either read or seen in the past week.**

| X (number of ads) | 3 | 7 | 4 | 2 | 0 | 4 | 1 | 2 |
|---|---|---|---|---|---|---|---|---|
| Y (cans purchased) | 11 | 18 | 9 | 4 | 7 | 6 | 3 | 8 |

**a) Develop the estimating equation that best fits the data.**

**b) Calculate the sample coefficient of determination and the sample coefficient of correlation.**

**Solution:**

| X | Y | XY | X2 | Y2 |
|---|---|---|---|---|
| 3 | 11 | 33 | 9 | 121 |
| 7 | 18 | 126 | 49 | 324 |
| 4 | 9 | 36 | 16 | 81 |
| 2 | 4 | 14 | 4 | 16 |
| 0 | 7 | 0 | 0 | 49 |
| 4 | 6 | 24 | 16 | 36 |
| 1 | 3 | 3 | 1 | 9 |
| 2 | 8 | 16 | 4 | 64 |
| 23 | 66 | 252 | 99 | 700 |

$$y = a + bx$$

$$\text{Where } b = \frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{n\Sigma x^2 - (\Sigma x)^2} = \frac{(8)(252)-(23)(66)}{(8)(99)-(23)^2}$$

$$= \frac{498}{263} = 1.89$$

$$a = \frac{\Sigma y - b\Sigma x}{n} = \frac{66-(1.89)(23)}{8} = 2.82$$

**The best fitted equation is**

$$y = 2.82 + 1.89\,x$$

$$r^2 = \frac{a\Sigma y + b\Sigma xy - n\overline{Y}^2}{\Sigma y^2 - n\overline{y}^2}$$

$$= \frac{(2.82)(66)+(1.89)(252)-(8)(8.25)^2}{700-(8)(8.25)^2}$$

$$= \frac{117.9}{155.5} = 0.76$$

*Now*

$$r = \sqrt{0.76} = 0.87$$

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**Q15: Eastern Digital has developed a substantial market sahre in the PC computer industry. The prices and number of units sold for their top four computer products from 1993 to 1996 were:**

| Model | Selling Price ($) 1993 | 1994 | 1995 | 1996 | Number sold (thousands) 1993 | 1994 | 1995 | 1996 |
|---|---|---|---|---|---|---|---|---|
| 0 | 1,894 | 1,906 | 1,938 | 1,957 | 84.6 | 86.9 | 98.4 | 107.5 |
| | 2,506 | 2,560 | 2,609 | 2,680 | 38.4 | 42.5 | 55.6 | 67.5 |
| | 1,403 | 1,440 | 1,462 | 1,499 | 87.4 | 99.4 | 109.7 | 134.6 |
| | 1,639 | 1,650 | 1,674 | 1,694 | 75.8 | 78.9 | 82.4 | 86.4 |

**Construct a Laspeyres index for each of these 4 years using 1993 as the base period.**

**Solution:**

| $P_0$ | $P_1$ | $P_2$ | $P_3$ | $Q_0$ | $P_0Q_0$ | $P_1Q_0$ | $P_2Q_0$ | $P_3Q_0$ |
|---|---|---|---|---|---|---|---|---|
| 1894 | 1906 | 1938 | 1957 | 84.6 | 160232.4 | 161247.6 | 163954.8 | 165562.2 |
| 2506 | 2560 | 2609 | 2680 | 38.4 | 96230.4 | 98304 | 100185.6 | 102912 |
| 1403 | 1440 | 1462 | 1499 | 87.4 | 122622.2 | 125856 | 127778.8 | 131012.6 |
| 1639 | 1650 | 1674 | 1694 | 75.8 | 124236.2 | 125070 | 126889.2 | 128405.2 |
| - | - | - | - | - | 503321.2 | 510477.6 | 518808.4 | 527892 |

$$P_{01} = \frac{\Sigma P_1 Q_0}{\Sigma P_0 Q_0} \times 100 = \frac{510477.6}{503321.2} \times 100 = 101.42$$

$$P_{02} = \frac{\Sigma P_2 Q_0}{\Sigma P_0 Q_0} \times 100 = \frac{518808.4}{503321.2} \times 100 = 103.08$$

$$P_{03} = \frac{\Sigma P_3 Q_0}{\Sigma P_0 Q_0} \times 100 = \frac{527892}{503321.2} \times 100 = 104.88$$

**Q15.1: Use the data from Exercies 16-14 to calculate a fiexd weight index for each year using 1993 prices as the base and the 1996 quantities as the fixed weights.**

**Solution:**

| $P_0$ | $P_1$ | $P_2$ | $P_3$ | $Q_2$ | $P_0Q_2$ | $P_1Q_2$ | $P_2Q_2$ | $P_3Q_2$ |
|---|---|---|---|---|---|---|---|---|
| 1894 | 1906 | 1938 | 1957 | 107.5 | `203605 | 20489.5 | 208335 | 210377.5 |
| 2506 | 2560 | 2609 | 2680 | 67.5 | 169155 | 172800 | 176107.5 | 180900 |
| 1403 | 1440 | 1462 | 1499 | 134.5 | 188703.5 | 193680 | 196639 | 201615.5 |
| 1639 | 1650 | 1674 | 1694 | 86.4 | 141609.6 | 142560 | 144633.6 | 146361.6 |
| - | - | - | - | - | 703073.1 | 529529.5 | 725715.1 | 739254.6 |

$$P_{01} = \frac{\Sigma P_1Q_2}{\Sigma P_0Q_2}\times 100 = \frac{529529.5}{703073.1}\times 100 = 75.32$$

$$P_{02} = \frac{\Sigma P_2Q_2}{\Sigma P_0Q_2}\times 100 = \frac{725715.1}{703073.1}\times 100 = 103.22$$

$$P_{03} = \frac{\Sigma P_3Q_2}{\Sigma P_0Q_2}\times 100 = \frac{739254.6}{703073.1}\times 100 = 105.15$$

**Q15.2: Use the data from Exercies 16-14 to calculate a paasche index for each year using 1994 as the base period.**

**Solution:**

| $P_1$ | $P_0$ | $P_2$ | $P_3$ | $Q_1$ | $Q_2$ | $Q_3$ | $P_0Q_1$ | $P_0Q_2$ | $P_0Q_3$ | $P_1Q_1$ | $P_2Q_2$ | $P_3Q_3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1894 | 1906 | 1938 | 1957 | 84.6 | 98.4 | 107.5 | 161247.6 | 187550.4 | 204895 | 16023204 | 190699.2 | 210377.5 |
| 2506 | 2560 | 2609 | 2680 | 38.4 | 55.6 | 67.5 | 98304 | 142336 | 172800 | 96230.4 | 145060.4 | 180900 |
| 1403 | 1440 | 1462 | 1499 | 87.4 | 109.7 | 134.6 | 125856 | 157968 | 193824 | 122622.2 | 160381.4 | 201765.4 |
| 1693 | 1650 | 1674 | 1694 | 75.8 | 82.4 | 86.4 | 125070 | 135960 | 142560 | 128329.4 | 137937.6 | 146361.6 |
| - | - | - | - | - | - | - | 510477.6 | 623814.4 | 714079 | 507414.4 | 634078.6 | 739404.5 |

$$P_{01} = \frac{\Sigma P_1 Q_1}{\Sigma P_0 Q_1} \times 100 = \frac{507414.4}{510477.6} \times 100 = 99.40$$

$$P_{02} = \frac{\Sigma P_2 Q_2}{\Sigma P_0 Q_2} \times 100 = \frac{634078.6}{623814.4} \times 100 = 101.65$$

$$P_{03} = \frac{\Sigma P_3 Q_3}{\Sigma P_0 Q_3} \times 100 = \frac{739404.5}{714079} \times 100 = 103.55$$

**Q15.3: Julie Pristash, the marketing manager or Mod-Stereo, a manufacturer of blank cassette tapes, has compiled the following information ragarding unit sales for 1993-1995. Using the average quantities sold from 1993 to 1995 as the fixed weights, calculate the fixed weight index for each of the years 1993 to 1995 based on 1993.**

| Length or Type | Retail Price | | | Average Quantity (x 100,000) |
|---|---|---|---|---|
| (Minutes | 1993 | 1994 | 1995 | 1993-1995 |
| 30 | $2.20 | $2.60 | $2.85 | 32 |
| 60 | 2.60 | 2.90 | 3.15 | 119 |
| 90 | 3.10 | 3.20 | 3.25 | 75 |
| 120 | 3.30 | 3.35 | 3.40 | 16 |

**Solution:**

| $P_0$ | $P_1$ | $P_2$ | $Q_2$ | $P_0Q_2$ | $P_1Q_2$ | $P_2Q_2$ |
|---|---|---|---|---|---|---|
| 2.20 | 2.60 | 2.85 | 32 | 70.4 | 83.2 | 91.2 |
| 2.60 | 2.90 | 3.15 | 119 | 309.4 | 345.1 | 374.85 |
| 3.10 | 3.20 | 3.25 | 75 | 232.5 | 240 | 243.75 |
| 3.30 | 3.35 | 3.40 | 16 | 52.8 | 53.6 | 54.4 |
| - | - | - | - | 665.1 | 721.9 | 764.2 |

$$P_{01} = \frac{\Sigma P_1Q_2}{\Sigma P_0Q_2} \times 100 = \frac{721.9}{665.1} \times 100 = 108.54 \qquad P_{02} = \frac{\Sigma P_1Q_2}{\Sigma P_0Q_2} \times 100 = \frac{764.2}{665.1} \times 100 = 114.90$$