**Chapter 8**

**Interval Estimation**

**Case Problem 1: *Young Professional* Magazine**

1. Descriptive Statistics for the quantitative variables follow:

**Variable N Mean SE Mean StDev Minimum Maximum Skewness**

Age 410 30.112 0.199 4.024 19.000 42.000 -0.03

Investments 410 28538 781 15811 0.000 133400 1.71

Transactions 410 5.973 0.153 3.101 0.000 21.000 1.21

Household Income 410 74460 1720 34818 16200 322500 2.01

Descriptive statistics for the qualitative variables follow:

Gender Male: 229 Proportion male: .5585

Plan R.E. purchase Yes: 181 Proportion yes: .4415

Broadband access Yes: 256 Proportion yes: .6244

Have Children Yes: 219 Proportion yes: .5341

2. 95% Confidence Intervals

Variable N Mean StDev SE Mean 95% CI

Age 410 30.1122 4.0240 0.1987 (29.7215, 30.5029)

Variable N Mean StDev SE Mean 95% CI

Household Income 410 74459.5 34818.2 1719.5 (71079.3, 77839.8)

We can conclude with 95% confidence that the mean age of subscribers to *Young Professional* is between 29.72 and 30.50 years of age. And, we can conclude with 95% confidence that the mean household income of subscribers is between $71,079 and $77,840.

3. 95% Confidence Intervals

Variable X N Sample p 95% CI

Broadband Access 256 410 0.624390 (0.577514, 0.671266)

Variable X N Sample p 95% CI

Have Children? 219 410 0.534146 (0.485861, 0.582431)

We can conclude with 95% confidence that the proportion of subscribers with broadband access is between 57.75% and 67.13% and that the proportion of subscribers with children is between 48.59% and 58.24%.

4. *Young Professional* should be a good advertising outlet for online brokers. We see that most of the subscribers have financial investments exclusive of their home (the mean amount is $28,538) and some of them have a substantial amount of investments. (Several have over $100,000 of investments). Another factor to consider is the number of stock, bond, and mutual fund transactions. The mean number is approximately 6 per year and several subscribers make significantly more transactions than that. Finally a large proportion of subscribers have broadband access (the sample proportion is .6244) and this makes them more likely to do business with an online broker.

5. The survey results allow us to estimate that the mean age of subscribers is 30.12 years and that 53.41% of subscribers have children. Given the age of subscribers, it is reasonable to assume that their children are young. Thus, we conclude that subscribers to *Young Professional* would be a good target market for companies selling educational software and computer games for young children.

6. A variety of answers are possible here. But, from the survey results, it seems clear that articles about investing would have appeal to many readers. Articles about real estate and architecture would probably appeal to those subscribers planning to make a real estate purchase. Technology related articles would probably appeal to readers as well as an occasional article on parenting and child care.

**Case Problem 2: Gulf Real Estate Properties**

The variables are as follows:

GV List The list price of a Gulf View condominium

GV Sale The sale price of the Gulf View condominium

GV Days The number of days to sell the Gulf View condominium

NGV List The list price of a No Gulf View condominium

NGV Sale The sale price of the No Gulf View condominium

NGV Days The number of days to sell the No Gulf View condominium

1/2. The results obtained using Minitab are as follows:

**Descriptive Statistics: GV List, GV Sale, GV Days, NGV List, NGV Sale, NGV Days**

Variable N Mean Median TrMean StDev SE Mean

GV List 40 474.0 437.0 462.0 197.3 31.2

GV Sale 40 454.2 417.5 441.2 192.5 30.4

GV Days 40 106.00 96.00 102.64 52.22 8.26

NGV List 18 212.8 212.5 210.0 48.9 11.5

NGV Sale 18 203.2 203.5 201.8 43.9 10.3

NGV Days 18 135.0 126.0 127.8 76.3 18.0

Variable Minimum Maximum Q1 Q3

GV List 169.9 975.0 332.7 551.9

GV Sale 165.0 975.0 314.3 530.6

GV Days 28.00 282.00 71.25 138.75

NGV List 148.0 322.0 174.9 241.0

NGV Sale 135.5 292.5 172.4 230.0

NGV Days 48.0 338.0 62.5 154.8

3. Gulf View condominiums are the more expensive as usually anticipated. A Gulf View condominium lists for a mean price of $474,000 and a median price of $437,000. A No Gulf View condominium lists for a mean price of $212,800 and a median price of $212,500. The Gulf View condominiums are over twice as expensive as the No Gulf View condominiums.

The standard deviation of the list price for Gulf View condominiums is $197,300 and the standard deviation of the list price for No Gulf View condominiums is $48,900. Thus, the Gulf View condominiums have a greater variation in list price.

The most expensive list-price is for a Gulf View condominium at $975,000 while the least expensive list-price is a No Gulf View condominium at $148,000.

A Box Plot shows that the No Gulf View condominiums do not have any outliers. A similar box plot shows the highest four Gulf View list prices are outliers: $885,000, $895,000 and two at $975,000. These show 4/40 or 10% of the Gulf View condominiums have an unusually high list price.

The mean number of days to sell a condominium is slightly better for Gulf View condominiums than for No Gulf View condominiums (106 days vs. 135 days). On average, it appears to take a little over three months to sell a Gulf View condominium and a little over four months to sell a No Gulf View condominium. The quickest sale was a Gulf View condominium that sold in less than a month (28 days). The slowest sale was for a No Gulf View condominium that took almost a year to sell (338 days).

Gulf View condominiums with a mean list price of $474,000 and a mean sale price of $454,200 sell on average $474,000 - $454,200 = $19,800 (4.2%) below list price. No Gulf View condominiums with a mean list price of $212,800 and a mean sale price of $203,200 appears to sell on average $212,800 - $203,200 = $9,600 (4.5%) below list price. There is only a small percentage difference in list and sale price for the two types of condominiums.

In summary, Gulf View condos are substantially more expensive and tend to sell slightly faster. The discount off the list price is roughly 4.0 to 4.5% for both Gulf View and No Gulf View condos.

4. Using the Minitab 1-Sample t procedure

Variable N Mean StDev SE Mean 95.0% CI

GV Sale 40 454.2 192.5 30.4 ( 392.7, 515.8)

GV Days 40 106.00 52.22 8.26 ( 89.30, 122.70)

95% Confidence Intervals:

Gulf View Mean Sales Price $392,700 to $515,800

Gulf View Mean Days to Sell 89 to 123

5. Using the Minitab 1-Sample t procedure

Variable N Mean StDev SE Mean 95.0% CI

NGV Sale 18 203.2 43.9 10.3 ( 181.4, 225.0)

NGV Days 18 135.0 76.3 18.0 ( 97.1, 172.9)

95% Confidence Intervals:

No Gulf View Mean Sales Price $181,400 to $225,000

No Gulf View Mean Days to Sell 97 to 173

6. Gulf View condominiums

With *n* = 40, the margin of error is $59,600. To reduce the margin of error to $40,000 the recommended sample size.



No Gulf View condominiums

With *n* = 18, the margin of error is $21,800. To reduce the margin of error to $15,000 the recommended sample size.



7. From part 3, a Gulf View condominium sells on average 4.2% below its list price.

The estimated selling price is $589,000 x .958 = $564,262. Using the mean days, it is estimated to sell in about 106 days.

From part 3, a No Gulf View condominium sells on average 4.5% below its list price.

The estimated selling price is $285,000 x .955 = $272,175. Using the mean days, it is estimated to sell in about 135 days.

**Case Problem 3: Metropolitan Research, Inc.**

Descriptive statistics are shown below.

|  |  |  |
| --- | --- | --- |
| Midpoint | Count |  |
| 25000 | 1 | \* |
| 35000 | 6 | \* \* \* \* \* \* |
| 45000 | 1 | \* |
| 55000 | 5 | \* \* \* \* \* |
| 65000 | 11 | \* \* \* \* \* \* \* \* \* \* \* |
| 75000 | 8 | \* \* \* \* \* \* \* \* |
| 85000 | 9 | \* \* \* \* \* \* \* \* \* |
| 95000 | 3 | \* \* \* |
| 105000 | 1 | \* |
| 115000 | 3 | \* \* \* |
| 125000 | 1 | \* |
| 135000 | 1 | \* |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | N | MEAN | MEDIAN | TRMEAN | STDEV | SEMEAN |
| MILES | 50 | 73340 | 72705 | 72705 | 24899 | 3521 |
|  | MIN | MAX | Q1 | Q3 |  |  |
| MILES | 25066 | 138114 | 59881 | 87309 |  |  |

The 95% confidence interval follows:

N MEAN STDEV SE MEAN 95.0 PERCENT C.I.

MILES 50 73340 24899 3521 ( 66264, 80416)

The 95% confidence interval for the population mean is 66,264 to 80,416 indicating that there is a 95% confidence that this interval contains the population mean.

The mean is 73,340 and median is 72,705. The first quartile of 59,881 shows 25% of the repairs occurred with less than 60,000 miles on the vehicle. Also, the histogram shows seven (14%) repairs occurred with less than 40,000 miles. These data tend to support the conclusion of early transmission failures for this automobile manufacturer.

In order to bring the precision for the population mean to within  5,000 miles a sample size of 96 automobile transmission repair records would be needed as follows.



Additional information that would be helpful in more fully evaluating the transmission problem include

1. transmission failure data for other automobile manufacturers

2. the proportion of all automobiles that experience the transmission failures

3. industry standards for transmission failures

With this information we could make comparative statements about how the manufacturer in question compares to other manufacturers as well as to industry standards. However, with the data available, the manufacturer in question appears to have problems with early transmission failures.