# Australasian business statistics

3rd edition

## Going further with Kaddstat

ONLINE GUIDE

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WILEY

## GOING FURTHER WITH KADDSTAT

- **Going further with KaddStat** is an online guide with stepped instructions to perform the textbook demonstration problems using enhanced **KaddStat Excel 2010** functionality. **Going further with KaddStat** can be downloaded for free from the student website, www.johnwiley.com.au/highered/black3e/.
- **KaddStat Excel 2010 Data Analysis Plug-in** and the Australasian data sets can be downloaded for free from the student website, www.johnwiley.com.au/highered/black3e/.

## GOING FURTHER WITH KADDSTAT

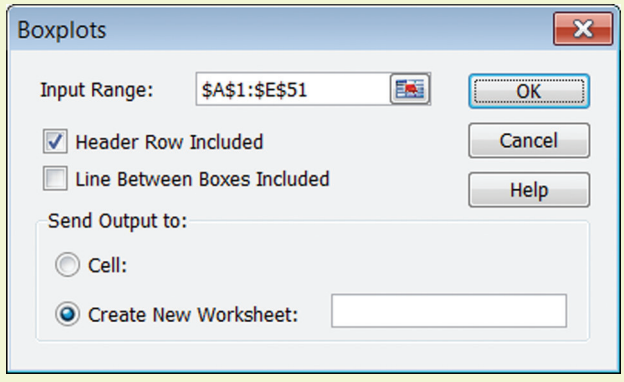
## DEMONSTRATION PROBLEM 3.7

One of the factors that universities are judged by in the *Good University Guide* is the starting salary of university graduates. To check the statistics reported by the *Good University Guide*, a regional university decided to survey recent graduates. The survey asked graduates their starting salary and degree. A random selection of 50 responses from each degree can be found on the student website in file DP03-07.xls. Draw boxplots to compare the starting salaries of graduates with different degrees.

### Drawing boxplots

DP03-07

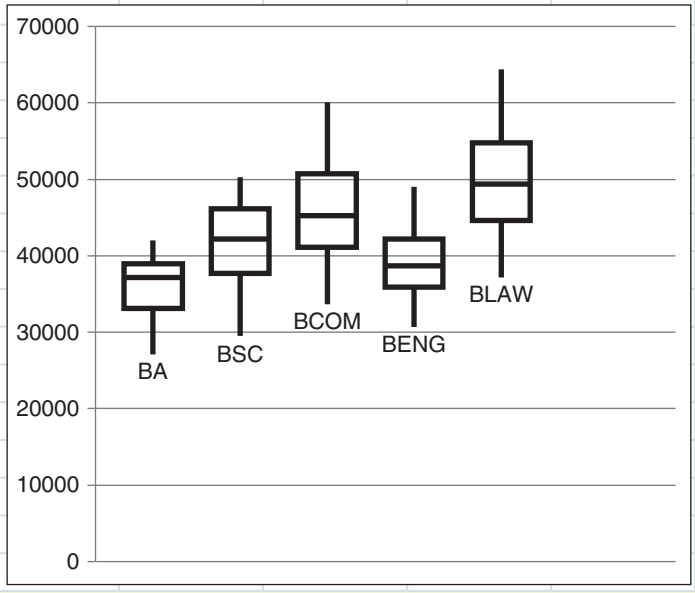
1. Access DP03-07.xls from the student website.
2. From the Add-Ins tab, select KADD and then Boxplots…
3. In the Boxplots dialogue box:
   a. enter the range of cells containing the data in the Input Range field. (*Note:* If the columns have unequal numbers of observations, you will need to perform a separate boxplot procedure for each column.)
   b. check Header Row Included if you have included the column headings in the input range. Otherwise, leave it unchecked.
   c. choose an output option




   d. click OK.

The Excel output using KaddStat follows.

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | **Boxplot Output** | BA | BSC | BCOM | BENG | BLAW |
| 2 | **First Quartile** | 33056.00 | 37609.00 | 41093.00 | 35850.00 | 44569.00 |
| 3 | **Median** | 37069.50 | 42179.00 | 45180.00 | 38620.00 | 49294.00 |
| 4 | **Third Quartile** | 38914.00 | 46063.00 | 50658.00 | 42154.00 | 54681.00 |
| 5 | **Interquartile Range** | 5858.00 | 8454.00 | 9565.00 | 6304.00 | 10112.00 |
| 6 | | | | | | |
| 7 | **Moderate Outliers (∆)** | 0 | 0 | 0 | 0 | 0 |
| 8 | **Extreme Outliers (▲)** | 0 | 0 | 0 | 0 | 0 |



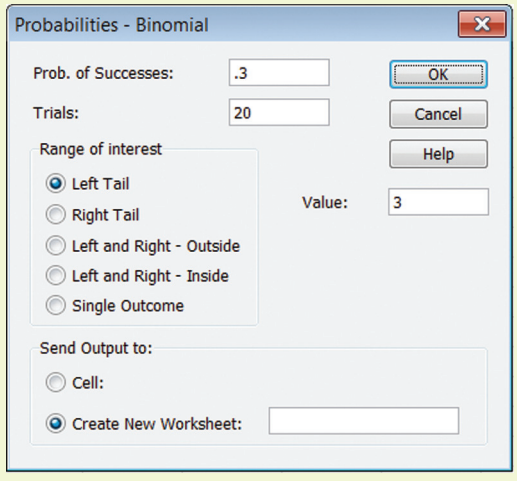

Based on the medians, the starting salaries of BA graduates appear to be the lowest, followed by the starting salaries of BEng graduates. Based on the interquartile range, the starting salaries of BA and BEng graduates display smaller levels of variability. The median starting salaries of BLaw graduates are higher than any of the other graduate groups considered in the survey, but also represent the graduates with the greatest variation in starting salaries based on the interquartile range. The first quartile measure indicates that 75% of BCom graduates earn $41 000 or more as a starting salary.

## DEMONSTRATION PROBLEM 5.5

Lenovo Group Limited, a Hong Kong IT company, has 30% share of the Hong Kong PC market. Suppose 20 new PC buyers are selected at random from the Hong Kong population. What is the probability that fewer than four bought their PC from Lenovo?

### Producing a binomial distribution

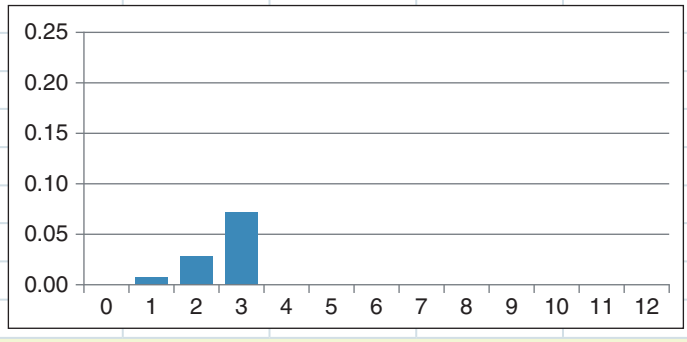
1. Open a new Excel file. From the KADD menu under the Add-Ins tab, choose Probabilities, and then Binomial...
2. In the Probabilities – Binomial dialogue box:
   a. enter .3 in the Prob. of Successes field
   b. enter 20 (the number of independent trials) in the Trials field
   c. select Left Tail in the Range of interest section
   d. enter 3 (the number of successes) in the Value field
   e. choose an output option




   f. click OK.

The Excel output using KaddStat follows.

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | **Binomial Distribution (Left Tail)** | | | | | | |
| 2 | **Probability** = | 0.1071 | | | | | |
| 3 | | | | | | | |
| 4 | **Mean** = | 6 | | | | | |
| 5 | **Standard Deviation** = | 2.04939 | | | | | |
| 6 | | | | | | | |
| 7 | **Prob. of Success** = | 0.3 | | | | | |
| 8 | **Number of Trials** = | 20 | | | | | |
| 9 | **X-value** = | 3 | | | | | |



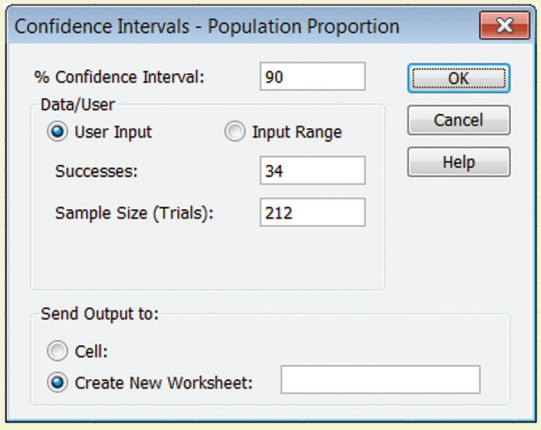

*Note:* Several choices are available under Range of interest in the Probabilities dialogue box. The most frequently used for the binomial distribution are Left Tail and Single Outcome. Experiment with these and the other options to discover which probability each one computes.

## DEMONSTRATION PROBLEM 8.5

A clothing company produces men's jeans. The jeans are made and sold with either a regular cut or a boot cut. In an effort to estimate the proportion of their men's jeans market in Wellington that prefers boot-cut jeans, an analyst takes a random sample of 212 jeans sales from the company's two Wellington retail outlets. Only 34 of the sales were boot-cut jeans. Construct a 90% confidence interval to estimate the proportion of the population in Wellington who buy the company's jeans who prefer the company's boot-cut jeans.

### Constructing confidence intervals of the population proportion

1. Open a new Excel file. From the Add-Ins tab, select KADD, Confidence Intervals, One Sample and then Population Proportion...
2. In the Confidence Intervals – Population Proportion dialogue box:
   a. enter 90 in the % Confidence Interval field
   b. in the Data/User section, choose User Input
   c. enter 34 in the Successes field
   d. enter 212 in the Sample Size (Trials) field
   e. choose an output option.




3. Click OK.

The Excel output using KaddStat follows.

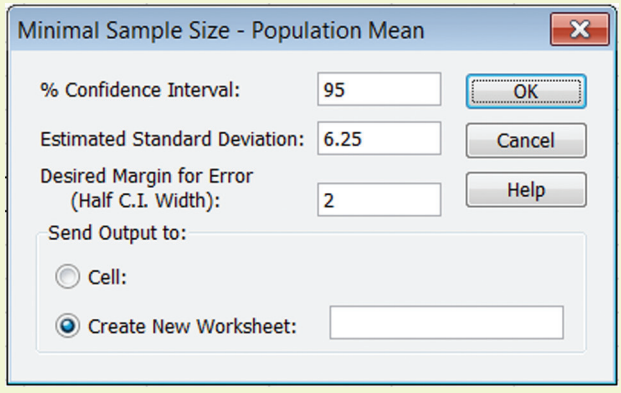
| | A | B |
|---|---|---|
| 1 | **Confidence interval for** | |
| 2 | **Population Proportion** | |
| 3 | Lower Limit = | 0.1189 |
| 4 | Upper Limit = | 0.2018 |
| 5 | Margin for Error (Half Width) = | 0.0415 |
| 6 | | |
| 7 | Successes = | 34 |
| 8 | Trials = | 212 |
| 9 | % Confidence Interval = | 90% |
| 10 | p-hat = | 0.160377 |

## DEMONSTRATION PROBLEM 8.7

Suppose you want to estimate the average age of all Boeing 727 aeroplanes now in active domestic service. You want to be 95% confident, and you want your estimate to be within 2 years of the actual figure. The 727 was first placed into service about 30 years ago, but you believe that no active 727s in the domestic fleet are more than 25 years old. How large a sample should you take?

### Calculating sample size

1. Open a new Excel file. From the Add-Ins tab, select KADD, Minimal Sample Size and then Population Mean...
2. In the Minimal Sample Size – Population Mean dialogue box:
   a. enter 95 in the % Confidence Interval field
   b. enter 6.25 in the Estimated Standard Deviation field
   c. enter 2 in the Desired Margin for Error (Half C.I. Width) field
   d. choose an output option.




3. Click OK.

The Excel output using KaddStat follows.

| | A | B |
|---|---|---|
| 1 | | |
| 2 | Minimal Sample Size = | 38.0 |
| 3 | | |
| 4 | Desired C.I. = | 95% |
| 5 | Estimated Std. Dev. = | 6.25 |
| 6 | Margin for Error (Half Width) = | 2 |

Note that sample size estimates of the population mean using the $t$ distribution where $\sigma$ is unknown are not shown here. Since a sample size must be known to determine the table value of $t$, which in turn is used to estimate the sample size, this procedure usually involves an iterative process.

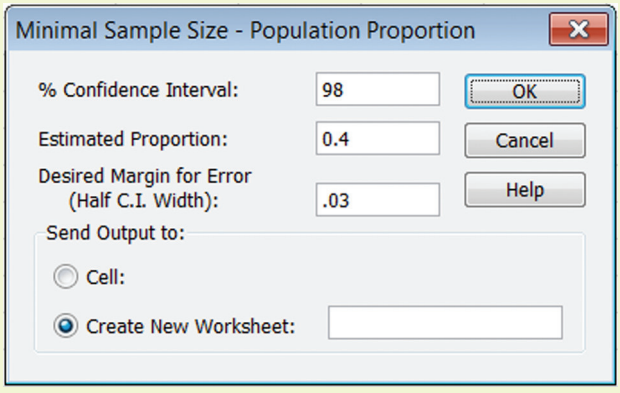
## DEMONSTRATION PROBLEM 8.8

Hewitt Associates conducted a national survey to determine the extent to which employers are promoting health and fitness among their employees. One of the questions asked was 'Does your company offer on-site exercise classes?' Calculate the sample size Hewitt Associates would need in order to estimate the population proportion to ensure 98% confidence that the results are within .03 of the true population proportion if:

1. it was estimated before the study that no more than 40% of the companies would answer yes.
2. there was no previous information available to make an approximation of the value of $\hat{p}$.

### Calculating sample size, with *p* unknown

1. Open a new Excel file. From the Add-Ins tab, select KADD, Minimal Sample Size and then Population Proportion...
2. In the Minimal Sample Size – Population Proportion dialogue box:
   a. enter 98 in the % Confidence Interval field
   b. enter 0.4 in the Estimated Proportion field
   c. enter .03 in the Desired Margin for Error (Half C.I. Width) field
   d. choose an output option.




3. Click OK.

The Excel output using KaddStat follows.

| | A | B |
|---|---|---|
| 1 | | |
| 2 | Minimal Sample Size = | 1444 |
| 3 | | |
| 4 | Desired C.I. = | 98% |
| 5 | Estimated Proportion = | 0.4 |
| 6 | Margin for Error (Half Width) = | 0.03 |

Note that the sample size in the output from KaddStat is 1444 and, from a hand calculation, the solution is 1448. The reason that these two sample size values are different is that, in the hand calculation, the *z*-score for a 98% confidence interval is taken from table A.5 as approximately 2.33. KaddStat, on the other hand, uses a much more precise value of *z*-score in calculating the sample size.

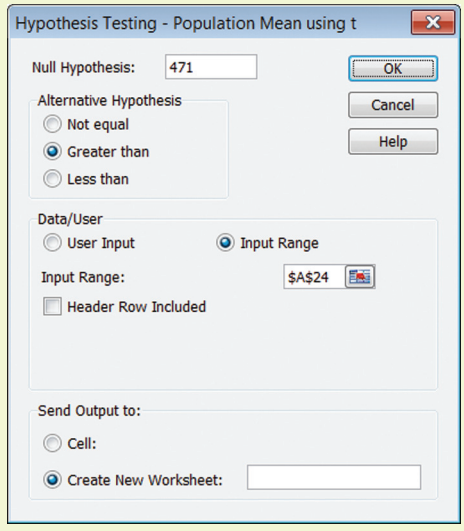
## DEMONSTRATION PROBLEM 9.2

Records show that the average farm size in a particular region has increased over the last 70 years. This trend might be explained, in part, by the inability of small farms to compete with the prices and costs of large-scale operations and to produce a level of income necessary to support the farmers' desired standard of living. An agribusiness researcher believes the average size of farms has continued to increase since 2007 from a mean of 471 hectares. To test this, a random sample of 23 farms was selected from official government sources and their sizes recorded. The data gathered are shown in table 9.3 in the textbook. Use $\alpha = .05$ to test the hypothesis.

### One-sample test for $\mu$

DP09-02

1. Access DP09-02.xls from the student website.
2. From the KADD menu under the Add-Ins tab, choose Hypothesis Testing and then One Sample and Population Mean using t…
3. In the Hypothesis Testing – Population Mean using t dialogue box:
   a. enter 471 in the Null Hypothesis field
   b. choose the appropriate Alternative Hypothesis
   c. choose Input Range under Data/User
   d. enter the data range in the Input Range field
   e. check Header Row Included if you have included the column label in the input range. If not, leave it unchecked.
   f. choose an output option.
4. Click OK.




The Excel output using KaddStat follows.

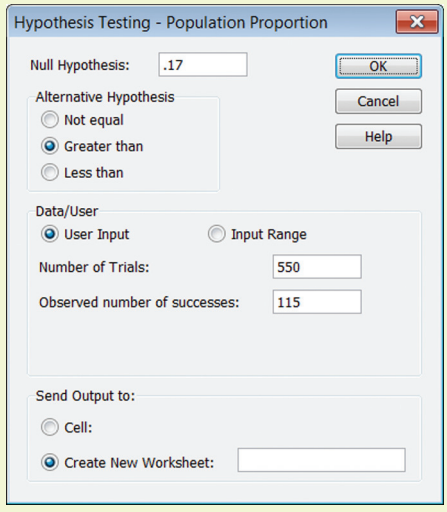
| | A | B |
|---|---|---|
| 1 | **Hypothesis Testing** | |
| 2 | **for Mean using t** | |
| 3 | p-value = | 0.00478164 |
| 4 | | |
| 5 | Null Hypothesis: μ = | 471 |
| 6 | Alternative Hypothesis: | Greater Than |
| 7 | Sample Size: n = | 23 |
| 8 | Sample Mean: $\bar{x}$ = | 498.7826 |
| 9 | Sample Standard Deviation: s = | 46.9429 |
| 10 | Standard Error: $SE_{\bar{x}}$ = | 9.7883 |

## DEMONSTRATION PROBLEM 9.3

A national survey found that 17% of Australians consume milk with their breakfast. However, in Victoria, a large milk producer believes that more than 17% of Victorians consume milk with their breakfast. To test this idea, a marketing organisation randomly selected 550 Victorians and asked if they consume milk with their breakfast. It was found that 115 did. Using a .05 level of significance, test the idea that more than 17% of Victorians consume milk with their breakfast.

### Performing a one sample test for *p*

1. Open a new Excel file. From the KADD menu under the Add-Ins tab, choose Hypothesis Testing, One Sample and Population Proportion...
2. In the Hypothesis Testing – Population Proportion dialogue box:
   a. enter .17 in the Null Hypothesis field
   b. choose the appropriate Alternative Hypothesis
   c. choose User Input under Data/User
   d. enter 550 in the Number of Trials field
   e. enter 115 in the Observed number of successes field
   f. choose an output option.




3. Click OK.

The Excel output using KaddStat follows.

| | A | B |
|---|---|---|
| 1 | **Hypothesis Testing for** | |
| 2 | **Population Proportion** | |
| 3 | p-value = | 0.00733178 |
| 4 | z-statistic = | 2.4406 |
| 5 | Null Hypothesis: $\pi$ = | 0.17 |
| 6 | Alternative Hypothesis: | Greater Than |
| 7 | Number of Trials: n = | 550 |
| 8 | Number of Successes = | 115 |
| 9 | p-hat = | 0.2091 |

## DEMONSTRATION PROBLEM 12.5

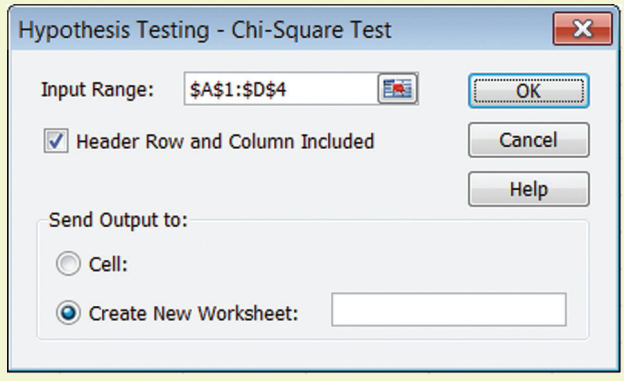
A traffic researcher believes that driver behaviour at a set of traffic lights in a suburban neighbourhood depends on the type of vehicle driven. She sorted types of vehicles into three categories: sedan, SUV and utility. Driver behaviour was determined by how a driver responded to the red light signal and had three categories: complete stop, near stop and did not stop. A random sample of 300 drivers produced the following contingency table of observed values. At the .01 level of significance, could there be a relationship between driver behaviour and type of vehicle driven?

| | Driver behaviour | | | |
|---|---|---|---|---|
| **Vehicle type** | **Complete stop** | **Near stop** | **Did not stop** | **Total** |
| **Sedan** | 102 | 80 | 50 | 232 |
| **SUV** | 30 | 18 | 15 | 63 |
| **Utility** | 13 | 12 | 20 | 45 |
| **Total** | 145 | 110 | 85 | 340 |

### Performing a chi-square test

DP12–05

1. Access DP12-05.xls from the student website.
2. From the KADD drop-down menu on the Add-Ins tab, select Hypothesis Testing and choose Chi-Square Test…
3. In the Hypothesis Testing – Chi-Square Test dialogue box:
   a. enter the location of the observed frequencies in the Input Range field
   b. check Header Row and Column Included if you have included the column and row labels in the Input Range. If not, leave it unchecked.
   c. choose an output option




   d. click OK.

The Excel output using KaddStat follows.

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | | **Chi-square test statistic =** | | 11.455 | | **Number of:** | |
| 2 | | | **p-value =** | 0.022 | | **rows =** | 3 |
| 3 | | | | | | **columns =** | 3 |
| 4 | | | | | | | |
| 5 | *Actual frequencies* | | | | | | |
| 6 | | | **Variable B** | | | | |
| 7 | | | Complete stop | Near stop | Did not stop | Totals | |
| 8 | **Variable A** | Sedan | 102 | 80 | 50 | 232 | |
| 9 | | SUV | 30 | 18 | 15 | 63 | |
| 10 | | Utility | 13 | 12 | 20 | 45 | |
| 11 | | Totals | 145 | 110 | 85 | 340 | |
| 12 | | | | | | | |
| 13 | *Expected frequencies* | | | | | | |
| 14 | | | **Variable B** | | | | |
| 15 | | | Complete stop | Near stop | Did not stop | Totals | |
| 16 | **Variable A** | Sedan | 98.9412 | 75.0588 | 58.0000 | 232 | |
| 17 | | SUV | 26.8676 | 20.3824 | 15.7500 | 63 | |
| 18 | | Utility | 19.1912 | 14.5588 | 11.2500 | 45 | |
| 19 | | Totals | 145 | 110 | 85 | 340 | |
| 20 | | | | | | | |
| 21 | | | | | | | |
| 22 | *Chi-square calculations* | | | | | | |
| 23 | | | **Variable B** | | | | |
| 24 | | | Complete stop | Near stop | Did not stop | | |
| 25 | **Variable A** | Sedan | 0.0946 | 0.3253 | 1.1034 | | |
| 26 | | SUV | 0.3652 | 0.2785 | 0.0357 | | |
| 27 | | Utility | 1.9973 | 0.4497 | 6.8056 | | |
| 28 | NOTE: Expected frequencies should not be less than 5.0 | | | | | | |

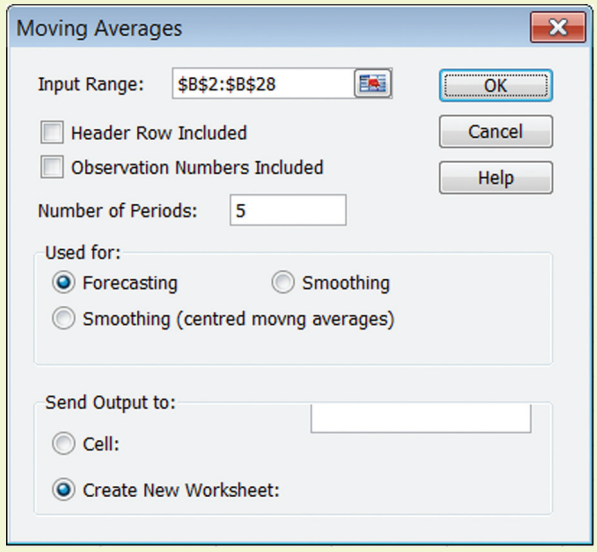
## DEMONSTRATION PROBLEM 16.1

The Australian housing approval data shown in figure 16.3 are provided in the Excel file DP16-01.xls, Compute a 5-year moving average for the series.

### Computing a moving average

DP16–01

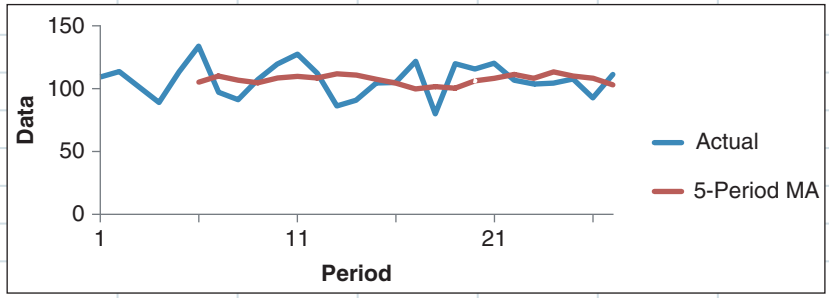
1. Access DP16-01.xls from the student website.
2. From the Add-Ins tab, choose KADD and select Time series and then Moving Averages…
3. In the Moving Averages dialogue box:
   a. enter the data range for Number of houses in '000s in the Input Range field.
   b. check Header Row Included if you have included the column heading. Otherwise, leave it unchecked.
   c. enter 5 in the Number of Periods field
   d. select Used for: Forecasting
   e. choose an output option.




   f. Click OK.

The Excel output using KaddStat follows.

| | A | B | C | D | E | F | G | H | I | J | K |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Period | Actual | 5-Period MA | %ABS Error | | | | | | | |
| 2 | 1 | 109 | | | | | | | | | |
| 3 | 2 | 114 | | | | | | | | | |
| 4 | 3 | 101 | | | | | | | | | |
| 5 | 4 | 88 | | | | | | | | | |
| 6 | 5 | 113 | | | | | | | | | |
| 7 | 6 | 134 | 105 | 21.40% | | | | | | | |
| 8 | 7 | 97 | 110 | 13.74% | | | | | | | |
| 9 | 8 | 91 | 107 | 17.14% | | | | | | | |
| 10 | 9 | 107 | 105 | 2.45% | | | | | | | |
| 11 | 10 | 120 | 108 | 9.61% | | | | | | | |
| 12 | 11 | 127 | 110 | 13.84% | | | | | | | |
| 13 | 12 | 113 | 108 | 3.66% | | | | | | | |
| 14 | 13 | 86 | 112 | 30.01% | | MAPE = | 11.93% | | | | |
| 15 | 14 | 91 | 111 | 21.67% | | | | | | | |
| 16 | 15 | 105 | 107 | 2.61% | | | | | | | |
| 17 | 16 | 105 | 104 | 0.50% | | | | | | | |
| 18 | 17 | 122 | 100 | 18.06% | | | | | | | |
| 19 | 18 | 79 | 102 | 28.32% | | | | | | | |
| 20 | 19 | 120 | 100 | 16.37% | | | | | | | |
| 21 | 20 | 115 | 106 | 8.04% | | | | | | | |
| 22 | 21 | 120 | 108 | 10.20% | | | | | | | |
| 23 | 22 | 106 | 111 | 4.49% | | | | | | | |
| 24 | 23 | 104 | 108 | 4.49% | | | | | | | |
| 25 | 24 | 104 | 113 | 8.40% | | | | | | | |
| 26 | 25 | 108 | 110 | 2.18% | | | | | | | |
| 27 | 26 | 92 | 109 | 17.73% | | | | | | | |
| 28 | 27 | 111 | 103 | 7.55% | | | | | | | |
| 29 | | | | | | | | | | | |



## DEMONSTRATION PROBLEM 16.2

The table below shows recent data for Australian consumption of unleaded petrol measured in megalitres. Use exponential smoothing to forecast the values for each time period. Work out the problem using alpha values of .2 and .8.

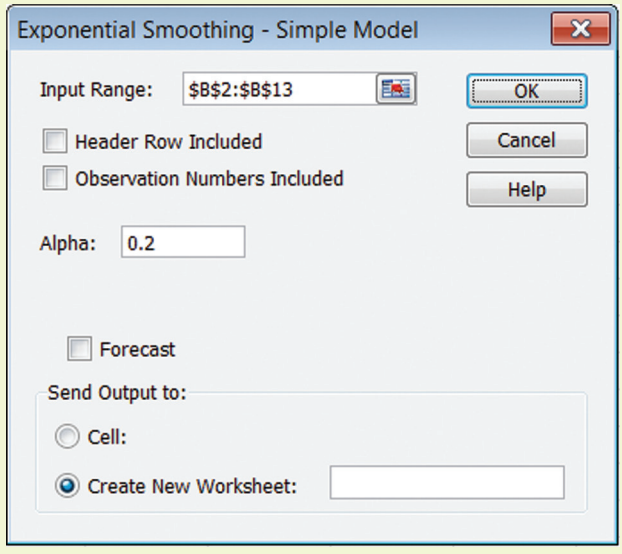
| Period | Consumption of unleaded petrol (megalitres) |
|---|---|
| 1 | 11 560 |
| 2 | 12 426 |
| 3 | 13 466 |
| 4 | 14 522 |
| 5 | 15 214 |
| 6 | 16 308 |
| 7 | 18 874 |
| 8 | 19 962 |
| 9 | 19 876 |
| 10 | 19 048 |
| 11 | 19 251 |
| 12 | 19 234 |

*Source:* ABARE statistics, accessed on April 2011 at http://www.abare.gov.au/publications_html/data/data/data.html

### Using exponential smoothing

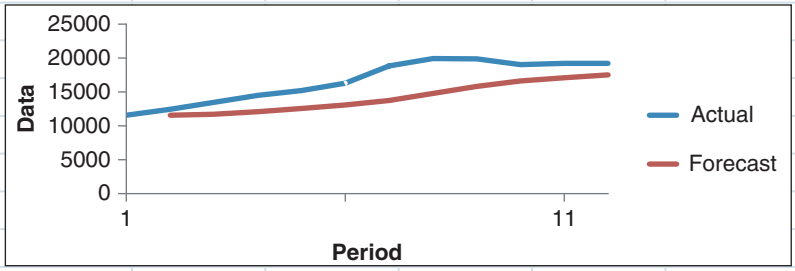
DP16–02

1. Access DP16-02.xls from the student website.
2. From the Add-Ins tab, choose KADD, Time Series, Exponential Smoothing and then Simple Model...
3. In the Exponential Smoothing – Simple Model dialogue box:
   a. enter the location of the data in the Input Range field
   b. check Header Row Included if you have included the column heading. Otherwise, leave it unchecked.
   c. enter 0.2 in the Alpha field
   d. choose an output option
   e. click OK.
4. Repeat the process for alpha = .8.



The Excel output using KaddStat for alpha = .2 follows.

| | A | B | C | D |
|---|---|---|---|---|
| 1 | Period | Actual | Forecast | %ABS Error |
| 2 | 1 | 11560 | | |
| 3 | 2 | 12426 | 11560.0000 | 6.97% |
| 4 | 3 | 13466 | 11733.2000 | 12.87% |
| 5 | 4 | 14522 | 12079.7600 | 16.82% |
| 6 | 5 | 15214 | 12568.2080 | 17.39% |
| 7 | 6 | 16308 | 13097.3664 | 19.69% |
| 8 | 7 | 18874 | 13739.4931 | 27.20% |
| 9 | 8 | 19962 | 14766.3945 | 26.03% |
| 10 | 9 | 19876 | 15805.5156 | 20.48% |
| 11 | 10 | 19048 | 16619.6125 | 12.75% |
| 12 | 11 | 19251 | 17105.2900 | 11.15% |
| 13 | 12 | 19234 | 17534.4320 | 8.84% |




| | F | G |
|---|---|---|
| 10 | MAPE = | 16.38% |
| 12 | Smoothing Constants | |
| 13 | Alpha = | 0.2 |

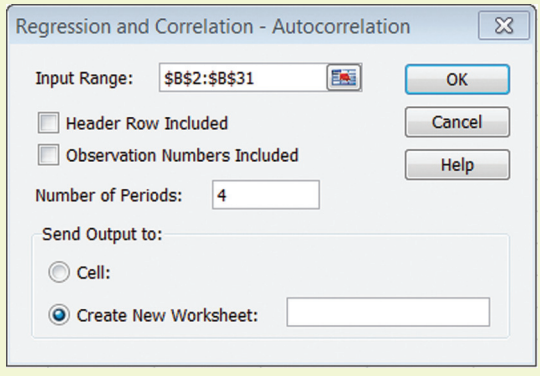
## K DEMONSTRATION PROBLEM 16.3

Although Excel can be used to deseasonalise time-series data, such as the Australian beer production data, KaddStat is faster and easier to use.

### Deseasonalising time-series data

DP16–03

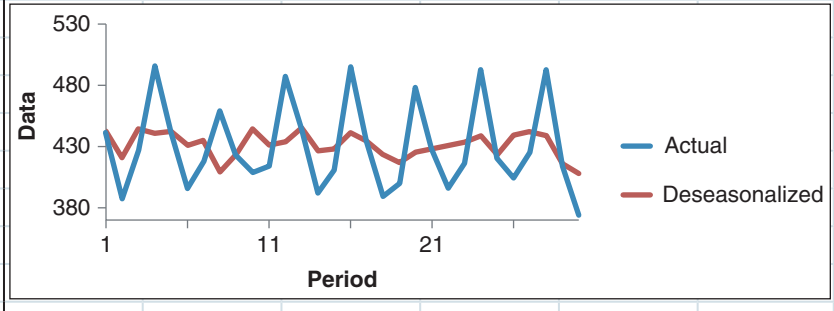
1. Access DP16-03.xls from the student website.
2. From the Add-Ins, choose KADD, Time Series and then Seasonal Index...
3. In the Seasonal Index dialogue box:
   a. enter the location of the data in the Input Range field
   b. check Header Row Included if you have included the column heading. Otherwise, leave it unchecked.
   c. enter 4 in the Number of Periods field
   d. choose an output option




   e. click OK.

The Excel output using KaddStat follows.

| | A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | |
| 2 | Period | Actual | Deseasonalized | | | | | | |
| 3 | 1 | 435 | 437 | | | | | | |
| 4 | 2 | 380 | 414 | | | | | | |
| 5 | 3 | 421 | 439 | | | | | | |
| 6 | 4 | 490 | 435 | | | | | | |
| 7 | 5 | 435 | 437 | | | | | | |
| 8 | 6 | 390 | 425 | | | | | | |
| 9 | 7 | 412 | 429 | | | | | | |
| 10 | 8 | 454 | 403 | | | | | | |
| 11 | 9 | 416 | 418 | | | | | | |
| 12 | 10 | 403 | 439 | | | | | | |
| 13 | 11 | 408 | 425 | | | | | | |
| 14 | 12 | 482 | 428 | | | | | | |
| 15 | 13 | 438 | 440 | | Seasonal Indexes | | | | |
| 16 | 14 | 386 | 421 | | 1 | 0.9959 | | | |
| 17 | 15 | 405 | 422 | | 2 | 0.9177 | | | |
| 18 | 16 | 491 | 436 | | 3 | 0.9595 | | | |
| 19 | 17 | 427 | 429 | | 4 | 1.1269 | | | |
| 20 | 18 | 383 | 417 | | | | | | |
| 21 | 19 | 394 | 411 | | | | | | |
| 22 | 20 | 473 | 420 | | | | | | |
| 23 | 21 | 420 | 422 | | | | | | |
| 24 | 22 | 390 | 425 | | | | | | |
| 25 | 23 | 411 | 428 | | | | | | |
| 26 | 24 | 488 | 433 | | | | | | |
| 27 | 25 | 415 | 417 | | | | | | |
| 28 | 26 | 398 | 434 | | | | | | |
| 29 | 27 | 419 | 436 | | | | | | |
| 30 | 28 | 488 | 433 | | | | | | |
| 31 | 29 | 414 | 416 | | | | | | |
| 32 | 30 | 374 | 408 | | | | | | |



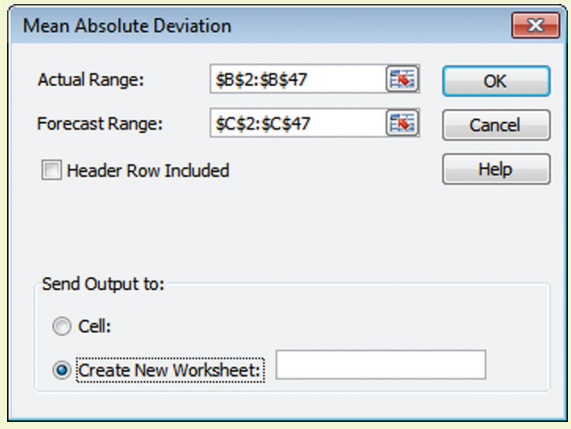
## DEMONSTRATION PROBLEM 16.7

Calculate MAD and MSE for the linear trend model forecasts for the average adult full-time weekly earnings time-series data shown in table 16.6.

### Calculating MAD and MSE

DP16–07

1. Access DP16-07.xls from the student website.
2. From the Add-Ins tab, choose KADD, Time Series and then Mean Absolute Deviation...
3. In the Mean Absolute Deviation dialogue box:
   a. for Actual Range, select the actual weekly adult earnings data (column B).
   b. for Forecast Range, select the predicted weekly adult earnings data (column C).
   c. check Header Row Included if you have included the column heading. Otherwise, leave it unchecked.
   d. choose an output option
   e. click OK.




The Excel output using KaddStat follows.

| | A | B |
|---|---|---|
| 1 | | |
| 2 | **Mean Absolute Deviation** | |
| 3 | | |
| 4 | $\Sigma\|e\| =$ | 508.7 |
| 5 | $n =$ | 46 |
| 6 | | |
| 7 | $\Sigma\|e\|/n =$ | 11.05869565 |

To calculate MSE, repeat steps 1 to 3, but select Mean Square Error... instead of Mean Absolute Deviation...

The Excel output using KaddStat follows.

| | A | B | C |
|---|---|---|---|
| 1 | | | |
| 2 | **Mean Square Error** | | |
| 3 | | | |
| 4 | $\Sigma e^2 =$ | 8183.61 | |
| 5 | $n =$ | 46 | |
| 6 | | | |
| 7 | $\Sigma e^2/n =$ | 177.9045652 | |
| 8 | | | |
| 9 | | | |

## DEMONSTRATION PROBLEM 17.1

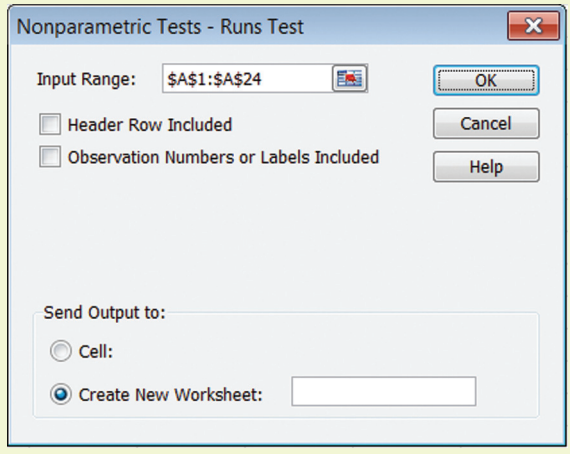
According to the *random walk hypothesis*, stock market prices move randomly over time with no specific pattern whatsoever. To test this hypothesis at the 5% significance level, a stock analyst randomly selected stock prices on each day and classified them according to whether the price was above the average closing price (A) or below the average closing price (B).

| Day | Price | Day | Price |
|---|---|---|---|
| 1 | A | 13 | A |
| 2 | A | 14 | A |
| 3 | B | 15 | B |
| 4 | A | 16 | B |
| 5 | A | 17 | B |
| 6 | B | 18 | A |
| 7 | A | 19 | A |
| 8 | A | 20 | A |
| 9 | B | 21 | A |
| 10 | B | 22 | A |
| 11 | A | 23 | B |
| 12 | A | 24 | A |

### Performing a runs test

DP17–01

1. Access DP17-01.xls from the student website.
2. From the Add-Ins group, choose KADD.
3. Select Hypothesis Testing, Nonparametric Tests and then Runs Test…
4. In the Nonparametric Tests – Runs Test dialogue box:
   a. enter the data range in the Input Range field
   b. choose an output option
   c. click OK.




The Excel output using KaddStat follows.

| | A | B | C |
|---|---|---|---|
| 1 | | | |
| 2 | **Analysis for Runs Test** | | |
| 3 | (Assumes $\alpha = 0.05$) | | |
| 4 | Number of observations of first kind: $n_1$ = | | 16 |
| 5 | Number of observations of second kind: $n_2$ = | | 8 |
| 6 | | Number of runs = | 11 |
| 7 | | Upper critical value is $R_U$ = | 17 |
| 8 | | Lower critical value is $R_L$ = | 6 |
| 9 | **Decision:** | Ho should not be rejected. | |

## DEMONSTRATION PROBLEM 17.3

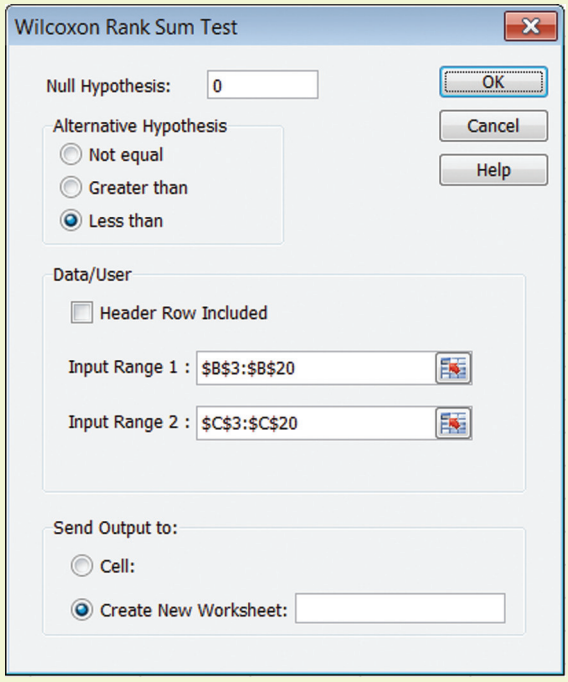
An advertising agency analyst wanted to know whether a recent national advertising campaign has been a success in boosting its client's sales. A simple random sample of 18 urban-based sales outlets in Australia were surveyed before and after the campaign and the total sales (in millions of dollars) were recorded. The data are shown in the following table. Conduct an appropriate hypothesis test to determine whether the campaign was a success.

| | Sales ($ million) | |
|---|---|---|
| Location | Before campaign | After campaign |
| 1 | 95 | 121 |
| 2 | 130 | 131 |
| 3 | 25 | 30 |
| 4 | 35 | 71 |
| 5 | 50 | 85 |
| 6 | 78 | 20 |
| 7 | 15 | 19 |
| 8 | 80 | 72 |
| 9 | 60 | 57 |
| 10 | 30 | 70 |
| 11 | 41 | 34 |
| 12 | 56 | 76 |
| 13 | 45 | 75 |
| 14 | 59 | 50 |
| 15 | 28 | 30 |
| 16 | 45 | 43 |
| 17 | 39 | 33 |
| 18 | 60 | 120 |

### Performing a Wilcoxon signed rank test

DP17–03

1. Access DP17-03.xls from the student website.
2. From the Add-Ins tab, choose KADD and select Hypothesis Testing, Nonparametric Tests and then Wilcoxon Matched-Pairs Signed Rank Test…
3. In the Wilcoxon Rank Sum Test dialogue box:
   a. select Less than for the Alternative Hypothesis
   b. enter the data ranges for the Input Range 1 and Input Range 2 fields
   c. choose an output option




d. click OK.

The Excel output using KaddStat follows.

| | A | B |
|---|---|---|
| 1 | | |
| 2 | **Wilcoxon** | |
| 3 | **Rank Sum Test** | |
| 4 | p-value = | 0.11134432 |
| 5 | | |
| 6 | Null Hypothesis = | 0 |
| 7 | Alternative Hypothesis: | Less Than |
| 8 | | |
| 9 | $\mu T$ = | 85.5 |
| 10 | $\sigma T$ = | 22.96192501 |
| 11 | T– = | 113.5 |
| 12 | T+ = | 57.5 |
| 13 | T = | 57.5000 |
| 14 | Trials = | 18 |
| 15 | z = | –1.219409958 |

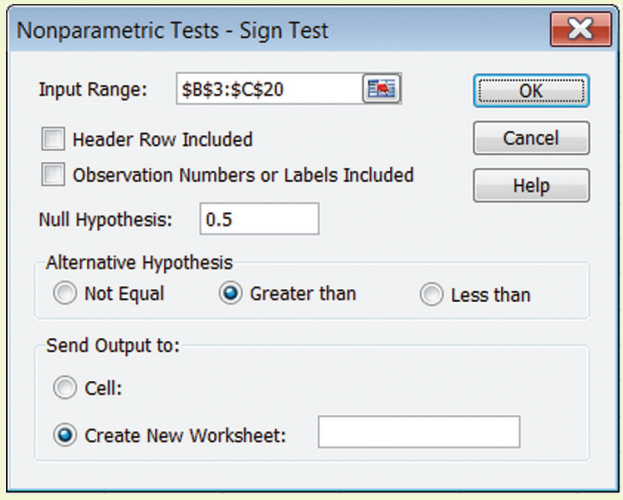
## DEMONSTRATION PROBLEM 17.4

Using the data in demonstration problem 17.3, apply the sign test to determine whether sales increased after the national advertising campaign. Let $\alpha = .01$.

### Performing a sign test

DP17–04

1. Access DP17-04.xls from the student website.
2. From the Add-Ins tab, choose KADD.
3. Select Hypothesis Testing, Nonparametric Tests and then Sign Test...
4. In the Nonparametric Tests – Sign Test dialogue box:
   a. enter the data range in the Input Range field
   b. enter the value for the null hypothesis (.5)
   c. select Greater than in the Alternative Hypothesis section
   d. choose an output option




   e. click OK.

The Excel output using KaddStat follows.

| | A | B |
|---|---|---|
| 1 | **Sign Test** | |
| 2 | p-value = | 0.17288929 |
| 3 | z-statistic = | 0.9428 |
| 4 | Null Hypothesis: $\pi$ = | 0.5 |
| 5 | Alternative Hypothesis: | Greater Than |
| 6 | Number of Trials: n = | 18 |
| 7 | Number of Successes = | 11 |

## DEMONSTRATION PROBLEM 17.5

An entrepreneur would like to acquire a new client server to handle general accounting and billing. A critical factor in her decision of which system to buy is reliability in terms of downtime: the length of time for which the system breaks down. A system is deemed to be more reliable if it has relatively shorter downtimes. The downtimes (in minutes) of three systems on her shortlist can be found in the following table. The entrepreneur is not willing to assume that the downtime populations are normally distributed and has decided to use the Kruskal–Wallis test rather than the one-way ANOVA. Test the hypothesis using $\alpha = .01$.

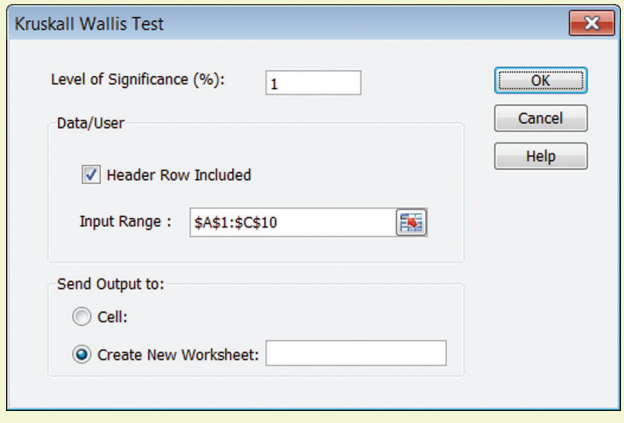
| System A | System B | System C |
|---|---|---|
| 10 | 19 | 2 |
| 9 | 22 | 3 |
| 15 | 25 | 1 |
| 6 | 20 | 5 |
| 10 | 18 | 8 |
| 20 | 14 | 16 |
| 11 | 25 | 7 |
| 6 | | 18 |
| 13 | | |

Here, $n_1 = 9$, $n_2 = 7$ and $n_3 = 8$, so $n = 24$.

### Performing a Kruskal–Wallis test

DP17–05

1. Access DP17-05.xls from the student website.
2. From the Add-Ins tab, select the KADD menu.
3. Choose Hypothesis Testing, Nonparametric Tests and then Kruskal Wallis Test . . .
4. In the Kruskal Wallis Test dialogue box:
   a. enter 1 for the Level of Significance (%)
   b. select Header Row Included
   c. enter the data range for the Input Range field
   d. choose an output option




   e. click OK.

The Excel output using KaddStat follows.

| | A | B |
|---|---|---|
| 1 | | |
| 2 | **Kruskal Wallis Test** | |
| 3 | | |
| 4 | n = | 24 |
| 5 | c = | 3 |
| 6 | Level of Significance = | 0.01 |
| 7 | | |
| 8 | $\chi^2$ Critical Value = | 9.2103 |
| 9 | Degrees of freedom = | 2 |
| 10 | | |
| 11 | $\sum T_j^2/n_j$ = | 4372.475694 |
| 12 | | |
| 13 | | |
| 14 | *K* = | 12.4495 |
| 15 | p-Value = | 0.001979805 |
| 16 | **Reject the null hypothesis.** | |

## DEMONSTRATION PROBLEM 17.6

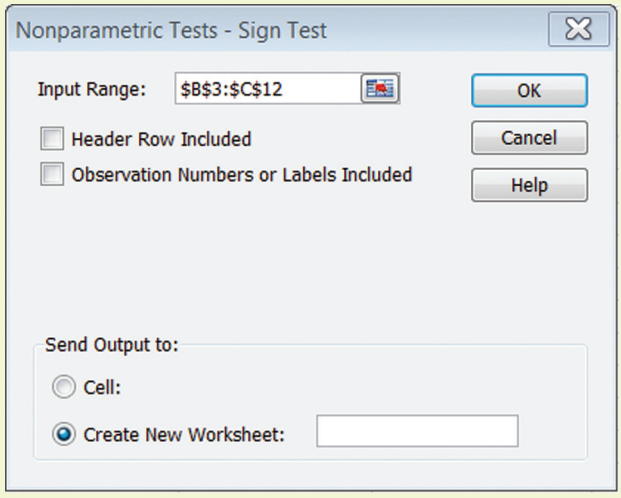
It is widely believed in economics that, due to insufficient domestic capital, developing countries need foreign direct investment (FDI) to augment their capital input into production processes in order to increase economic growth. If this is true, we expect to see a positive correlation between economic growth and FDI. The table below shows data for the growth rate of real per capita gross domestic product (GDP) and FDI (as a percentage of real GDP) for a random sample of Asia–Pacific countries. Compute a Spearman's coefficient of rank correlation for these data. Comment on your results. Test at $\alpha = .05$ whether the relationship between real per capita GDP and FDI is statistically significant.

| Country | GDP per capita growth (annual %) | Foreign direct investment (FDI), net inflows (% of GDP) |
|---|---|---|
| Bangladesh | 4.7 | 1.27 |
| Cambodia | 4.9 | 7.88 |
| Fiji | –0.4 | 8.68 |
| Malaysia | 2.9 | 3.33 |
| Nepal | 3.4 | 0.01 |
| Philippines | 1.9 | 0.93 |
| Thailand | 1.8 | 3.13 |
| Tonga | 1.5 | 1.20 |
| Vanuatu | 3.7 | 6.39 |
| Vietnam | 5.0 | 10.61 |

## Calculating a Spearman's rank correlation

DP17–06

1. Access DP17-06.xls from the student website.
2. From the Add-Ins tab, choose KADD.
3. Select Hypothesis Testing, Nonparametric Tests and then Spearman's rho…
4. In the Nonparametric Tests — Spearman's rho dialogue box:
   a. enter the data range in the Input Range field
   b. choose an output option




   c. click OK.

The Excel output using KaddStat follows.

| | A | B |
|---|---|---|
| 1 | | |
| 2 | **Spearman's rank correlation** | |
| 3 | Sample Size = | 10 |
| 4 | Spearman's Rho = | 0.29697 |

## DEMONSTRATION PROBLEM 18.1

A manufacturing facility produces bearings. The diameter specified for the bearings is 5 millimetres. Every 10 minutes, six bearings are sampled and their diameters are measured and recorded. Twenty of these samples of six bearings are gathered. Use the resulting data and construct an $\bar{x}$ chart.

| Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 |
|---|---|---|---|---|
| 5.13 | 4.96 | 5.21 | 5.02 | 5.12 |
| 4.92 | 4.98 | 4.87 | 5.09 | 5.08 |
| 5.01 | 4.95 | 5.02 | 4.99 | 5.09 |
| 4.88 | 4.96 | 5.08 | 5.02 | 5.13 |
| 5.05 | 5.01 | 5.12 | 5.03 | 5.06 |
| 4.97 | 4.89 | 5.04 | 5.01 | 5.13 |

| Sample 6 | Sample 7 | Sample 8 | Sample 9 | Sample 10 |
|---|---|---|---|---|
| 4.98 | 4.99 | 4.96 | 4.96 | 5.03 |
| 5.02 | 5.00 | 5.01 | 5.00 | 4.99 |
| 4.97 | 5.00 | 5.02 | 4.91 | 4.96 |
| 4.99 | 5.02 | 5.05 | 4.87 | 5.14 |
| 4.98 | 5.01 | 5.04 | 4.96 | 5.11 |
| 4.99 | 5.01 | 5.02 | 5.01 | 5.04 |

| Sample 11 | Sample 12 | Sample 13 | Sample 14 | Sample 15 |
|---|---|---|---|---|
| 4.91 | 4.97 | 5.09 | 4.96 | 4.99 |
| 4.93 | 4.91 | 4.96 | 4.99 | 4.97 |
| 5.04 | 5.02 | 5.05 | 4.82 | 5.01 |
| 5.00 | 4.93 | 5.12 | 5.03 | 4.98 |
| 4.90 | 4.95 | 5.06 | 5.00 | 4.96 |
| 4.82 | 4.96 | 5.01 | 4.96 | 5.02 |

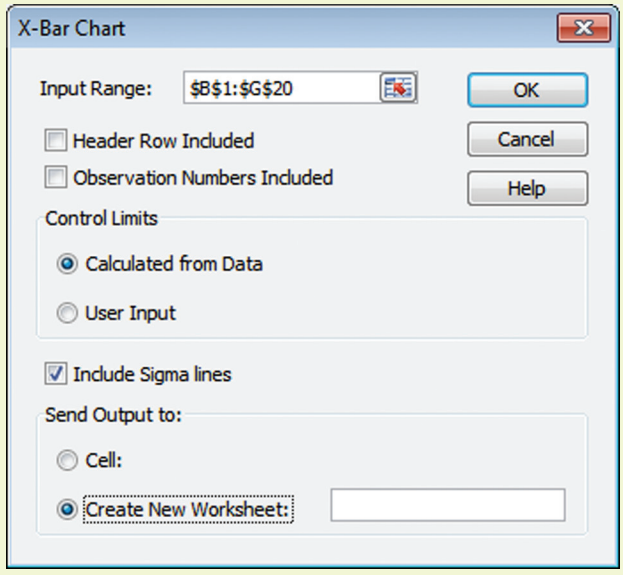
| Sample 16 | Sample 17 | Sample 18 | Sample 19 | Sample 20 |
|---|---|---|---|---|
| 5.01 | 5.05 | 4.96 | 4.90 | 5.04 |
| 5.04 | 4.97 | 4.93 | 4.85 | 5.03 |
| 5.09 | 5.04 | 4.97 | 5.02 | 4.97 |
| 5.07 | 5.03 | 5.01 | 5.01 | 4.99 |
| 5.12 | 5.09 | 4.98 | 4.88 | 5.05 |
| 5.13 | 5.01 | 4.92 | 4.86 | 5.06 |

### Constructing an $\bar{x}$ chart

DP18–01

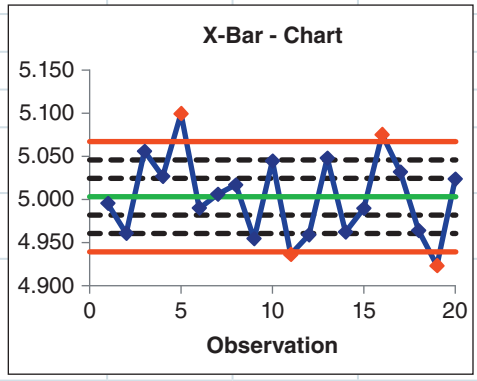
1. Access DP18-01.xls from the student website.
2. From the Add-Ins tab, select KADD.
3. Select Quality Control and then X-Bar Chart… from the drop-down menu.

4. In the X-Bar Chart dialogue box:
   a. enter the data range in the Input Range field
   b. in the Control Limits section, check Calculated from Data
   c. check Include Sigma lines
   d. choose an output option
   e. click OK.




The Excel output using KaddStat follows.

| | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|
| 1 | | | | | | | |
| 2 | | **X-Bar Chart** | | | | | |
| 3 | **UCL** | 5.068 | | | | | |
| 4 | **X-Bar-Bar** | 5.002 | | | | | |
| 5 | **LCL** | 4.936 | | | | | |
| 6 | **Estimated Sigma** | 0.054 | | | | | |
| 7 | **Estimated Standard Error** | 0.0219 | | | | | |
| 8 | | | | | | | |
| 9 | **Special Concerns** | **Observation(s)** | | | | | |
| 10 | Below LCL | 11, 19 | | | | | |
| 11 | Above UCL | 5, 16 | | | | | |
| 12 | 7 in a row up or down | | | | | | |
| 13 | 8 in a row above or below centreline | | | | | | |
| 14 | 2 of 3 in a row beyond 2 sigma | 1–3, 2–4, 3–5, 9–11, 10–12, 11–13, 12–14 | | | | | |
| 15 | 4 of 5 beyond 1 sigma | 1–5, 2–6, 8–12, 9–13, 10–14, 11–15, 12–16, 13–17, 14–18, 15–19, 16–20 | | | | | |
| 16 | | | | | | | |




The KaddStat output shows the centreline (green), control limits (red) and the estimated standard deviation and standard error. In addition, KaddStat provides information called 'Special Concerns' that may indicate that the process is not in control.

## DEMONSTRATION PROBLEM 18.2

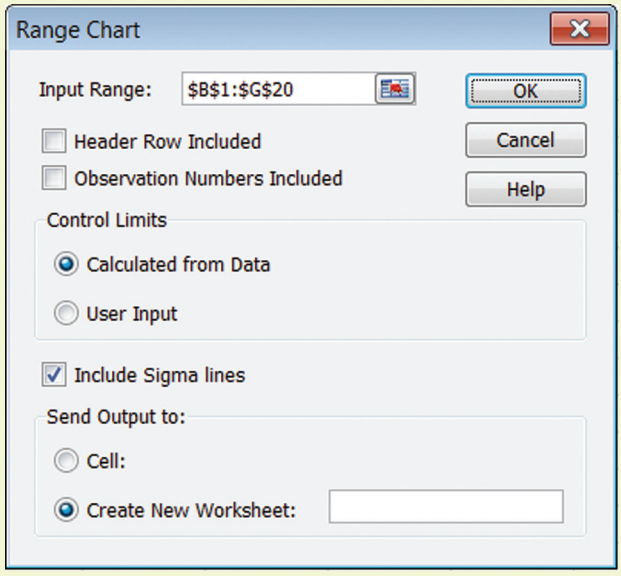
| Sample | Range |
|---|---|
| 1 | 0.25 |
| 2 | 0.12 |
| 3 | 0.34 |
| 4 | 0.10 |
| 5 | 0.07 |
| 6 | 0.05 |
| 7 | 0.03 |
| 8 | 0.09 |
| 9 | 0.14 |
| 10 | 0.18 |
| 11 | 0.22 |
| 12 | 0.11 |
| 13 | 0.16 |
| 14 | 0.21 |
| 15 | 0.06 |
| 16 | 0.12 |
| 17 | 0.12 |
| 18 | 0.09 |
| 19 | 0.17 |
| 20 | 0.09 |

Construct an *R* chart for the 20 samples of data related to bearings in demonstration problem 18.1.

### Constructing a range chart

DP18–02

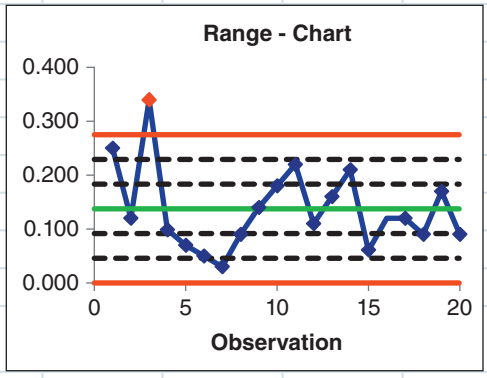
1. Access DP18-02.xls from the student website.
2. From the Add-Ins tab, select KADD.
3. Select Quality Control and then Range Chart… from the drop-down menu.
4. In the Range Chart dialogue box:
   a. enter the data range in the Input Range field
   b. in the Control Limits section, check Calculated from Data
   c. select Include Sigma lines
   d. choose an output option




e. click OK.

The Excel output using KaddStat follows.

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| 2 | | **Range Chart** | | | | | | |
| 3 | **UCL** | 0.273 | | | | | | |
| 4 | **R-Bar** | 0.136 | | | | | | |
| 5 | **LCL** | 0.000 | | | | | | |
| 6 | **Estimated Sigma(R)** | 0.046 | | | | | | |
| 7 | | | | | | | | |
| 8 | **Special Concerns** | **Observation(s)** | | | | | | |
| 9 | Below LCL | | | | | | | |
| 10 | Above UCL | 3 | | | | | | |
| 11 | 7 in a row up or down | | | | | | | |
| 12 | 8 in a row above or below centerline | | | | | | | |
| 13 | | | | | | | | |




The KaddStat output is the range chart, showing the centreline (green), control limits (red) and the estimated standard deviation and standard error. In addition, KaddStat provides information called 'Special Concerns' that may indicate that the process is not in control.

## DEMONSTRATION PROBLEM 18.3

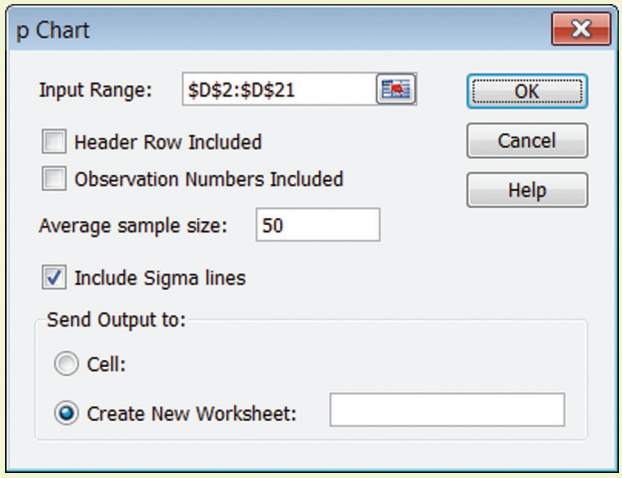
A company produces bond paper and, at regular intervals, samples of 50 sheets of paper are inspected. Suppose 20 random samples of 50 sheets of paper each are taken during a certain period of time, with the following numbers of sheets in noncompliance per sample. Construct a *p* chart from these data.

| Sample | *n* | Out of compliance |
|---|---|---|
| 1 | 50 | 4 |
| 2 | 50 | 3 |
| 3 | 50 | 1 |
| 4 | 50 | 0 |
| 5 | 50 | 5 |
| 6 | 50 | 2 |
| 7 | 50 | 3 |
| 8 | 50 | 1 |
| 9 | 50 | 4 |
| 10 | 50 | 2 |
| 11 | 50 | 2 |
| 12 | 50 | 6 |
| 13 | 50 | 0 |
| 14 | 50 | 2 |
| 15 | 50 | 1 |
| 16 | 50 | 6 |
| 17 | 50 | 2 |
| 18 | 50 | 3 |
| 19 | 50 | 1 |
| 20 | 50 | 5 |

### Constructing a *p* chart

DP18–03

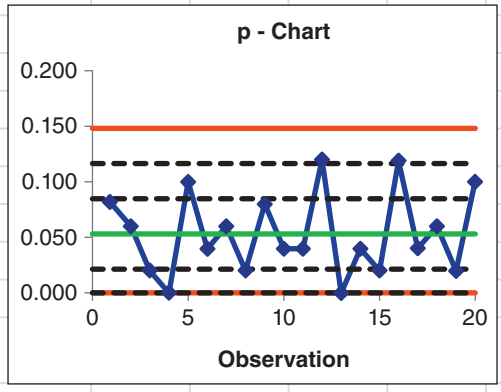
1. Access DP18-03.xls from the student website.
2. From the Add-Ins tab, select KADD.
3. Select Quality Control and then p Chart… from the drop-down menu.
4. In the p Chart dialogue box:
   a. enter the data range (i.e. the sample proportion) in the Input Range field
   b. in the Average sample size field, enter 50 (i.e. *n*)
   c. select Include Sigma lines
   d. choose an output option




e. click OK.

The Excel output using KaddStat follows.

| | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | |
| 2 | | **p Chart** | | | | | | |
| 3 | **UCL** | 0.148 | | | | | | |
| 4 | **p-Bar** | 0.053 | | | | | | |
| 5 | **LCL** | –0.042 | | | | | | |
| 6 | **Estimated Sigma(p)** | 0.032 | | | | | | |
| 7 | | | | | | | | |
| 8 | **Sample Size** | 50 | | | | | | |
| 9 | | | | | | | | |
| 10 | **Special Concerns** | **Observation(s)** | | | | | | |
| 11 | Below LCL | | | | | | | |
| 12 | Above UCL | | | | | | | |
| 13 | 7 in a row up or down | | | | | | | |
| 14 | 8 in a row above or below centerline | | | | | | | |
| 15 | | | | | | | | |
| 16 | | | | | | | | |




The KaddStat output shows the centreline (green), control limits (red) and the estimated standard deviation. In addition, KaddStat provides information called 'Special Concerns' that may indicate that the process is not in control.

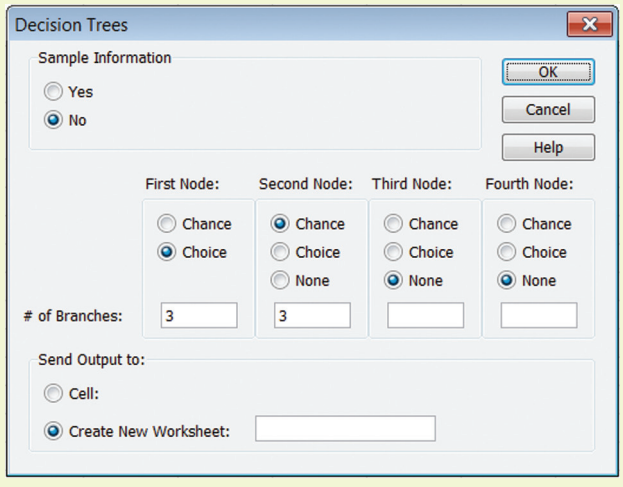
## DEMONSTRATION PROBLEM 19.2

Recall the restaurant decision problem presented in demonstration problem 19.1 in the textbook. Suppose probabilities have been determined for the states of population growth such that there is a .20 probability that there will be high population growth, a .30 probability that there will be moderate population growth and a .50 probability that there will be low population growth. Use the data presented in the problem, which are restated here, and the included probabilities to compute expected monetary values and reach a decision based on these findings.

| | Population growth | | |
|---|---|---|---|
| **Decision alternative** | **Low (.50)** | **Moderate (.30)** | **High (.20)** |
| **Small-scale expansion** | $45 | $40 | $30 |
| **Medium-scale expansion** | –$10 | $90 | $150 |
| **Large-scale expansion** | –$100 | $80 | $300 |

### Using decision trees without sample information

1. Open a new Excel file.
2. From the Add-Ins tab, select KADD, Decision Theory and then Decision Trees…
3. In the Decision Trees dialogue box:
   a. in the Sample Information section, choose No, because this problem does not involve sample information
   b. select Choice for First Node. In the # of Branches field below it, enter 3. (This decision problem involves two nodes or stages. In the first node, there are three possible choices: small-scale expansion, medium-scale expansion and large-scale expansion.)
   c. select Chance for Second Node. In the # of Branches field below it, enter 3. (In the second node, there are three possible states of nature or chance outcomes: low growth, moderate growth and high growth.)
   d. select None for Third Node and Fourth Node, because there are no further nodes. The # of Branches sections are zero by default.
   e. select an output option




   f. click OK.

4. In the new worksheet, enter the labels for the three decisions (Decision1, Decision2 and Decision3); enter the labels for the three possible states of nature (SofN1, SofN2 and SofN3).
5. Enter the given probabilities (Probability1, Probability2 and Probability3) for the three states of nature and enter the payoffs in column D for all 9 expected monetary payoffs.

The Excel output using KaddStat follows.

| | A | B | C | D |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | Low growth | 45 |
| 3 | | | 0.50 | |
| 4 | | Small-scale expansion | Moderate growth | 40 |
| 5 | | 40.5 | 0.30 | |
| 6 | | | High growth | 30 |
| 7 | | | 0.20 | |
| 8 | | | Low growth | –10 |
| 9 | | | 0.50 | |
| 10 | 52 | Medium-scale expansion | Moderate growth | 90 |
| 11 | | 52 | 0.30 | |
| 12 | | | High growth | 150 |
| 13 | | | 0.20 | |
| 14 | | | Low growth | –100 |
| 15 | | | 0.50 | |
| 16 | | Large-scale expansion | Moderate growth | 80 |
| 17 | | 34 | 0.30 | |
| 18 | | | High growth | 300 |
| 19 | | | 0.20 | |

## K DEMONSTRATION PROBLEM 19.4

In demonstration problem 19.1 in the textbook, the decision makers were faced with the problem of which expansion strategy to adopt. In this demonstration problem, we have reduced the decision alternatives to two: medium- and large-scale expansion. Use the following decision table to create a decision tree that displays the decision alternatives, payoffs, probabilities, states of demand and expected monetary payoffs. Suppose the cost of obtaining forecasts on population growth is $12 (recall that amounts are in $ millions). Incorporate this fact into your decision. Calculate the expected value of sampling information for this problem. Is it worthwhile for the company to buy the information?

The decision alternatives are: medium-scale expansion or large-scale expansion. The states of population growth and the prior probabilities are: low growth (.50), moderate growth (.30) and high growth (.20).

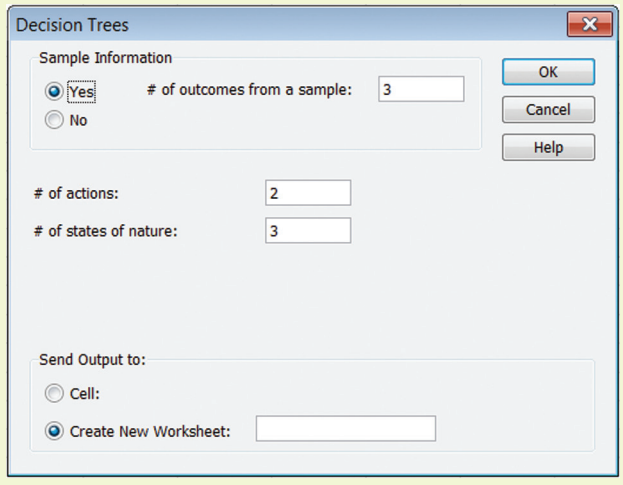
| Decision alternative | State of population growth | | |
|---|---|---|---|
| | Low growth (.50) | Moderate growth (.30) | High growth (.20) |
| Medium-scale expansion | –$10 | $90 | $150 |
| Large-scale expansion | –$100 | $80 | $300 |

The population forecaster has historically not been accurate 100% of the time. For example, in a period of low population growth, the forecaster correctly predicted it .80 of the time. When there was moderate population growth, the forecaster correctly predicted it .70 of the time. Sixty per cent of the time the forecaster correctly forecast high population growth when there actually was high growth. Shown below are the probabilities that the forecaster will predict a particular state of population growth under the actual states of population growth.

| Forecast | State of population growth | | |
|---|---|---|---|
| | Low growth | Moderate growth | High growth |
| Low growth | .80 | .15 | .05 |
| Moderate growth | .15 | .70 | .35 |
| High growth | .05 | .15 | .60 |

## Using decision trees with sample information

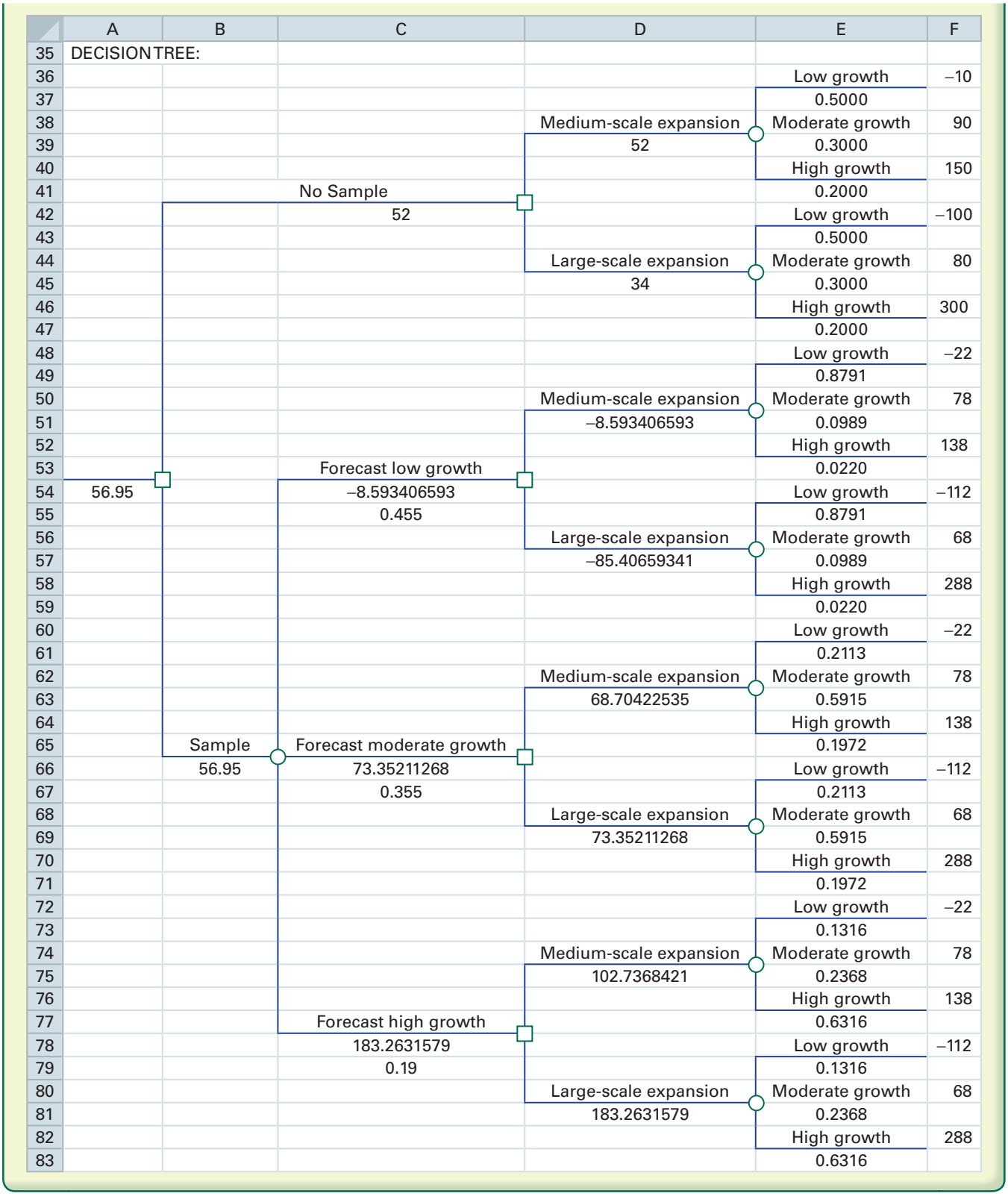
1. Open a new Excel file.
2. From the Add-Ins tab, select KADD, Decision Theory and then Decision Trees…
3. In the Decision Trees dialogue box:
   a. select Yes in the Sample Information section
   b. enter 3 for # of outcomes from a sample, because there are three possible outcomes from the forecast
   c. enter 2 for # of actions, for the medium-scale expansion and large-scale expansion decision alternatives
   d. enter 3 for # of states of nature (the states of nature are low growth, moderate growth and high growth)
   e. select an output option
   f. click OK.




4. In the resulting worksheet:
   a. enter 12 in the Cost of Sample cell in the top right-hand side
   b. enter the following labels for Sample Results: Forecast low growth, Forecast moderate growth and Forecast high growth
   c. in the States of Nature cells, enter the labels for the three states of nature (Low growth, Moderate growth and High growth) and their given prior probabilities (0.5, 0.3, 0.2)
   d. in the Likelihoods cells, enter the probabilities of *forecasting* each of the three states of nature given the occurrence of a state of nature (from the second table, above)
   e. in the Actions cells, enter the labels for the two actions (Medium-scale expansion and Large-scale expansion). Enter the values of the payoffs for each action and for each of the three states of nature.

The Excel output using KaddStat is shown on the following pages.

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | **INPUT: (Please fill in Shaded Areas)** | | | | |
| 2 | **Sample Results** | | **Cost of Sample =** | 12 | |
| 3 | Forecast low growth | | | | |
| 4 | Forecast moderate growth | | | | |
| 5 | Forecast high growth | | | | |
| 6 | | | **Likelihoods** | | |
| 7 | **States of Nature** | **Priors** | **Forecast low growth** | **Forecast moderate growth** | **Forecast high growth** |
| 8 | Low growth | 0.50 | 0.80 | 0.15 | 0.05 |
| 9 | Moderate growth | 0.30 | 0.15 | 0.70 | 0.15 |
| 10 | High growth | 0.20 | 0.05 | 0.35 | 0.60 |
| 11 | | | **Payoffs** | | |
| 12 | **Actions** | **Low growth** | **Moderate growth** | **High growth** | |
| 13 | Medium-scale expansion | –10 | 90 | 150 | |
| 14 | Large-scale expansion | –100 | 80 | 300 | |
| 15 | **TABULAR FORMAT:** | | | | |
| 16 | **Sample Result =** | Forecast low growth | | | |
| 17 | **States of Nature** | **Prior** | **Likelihood** | **Prior*Likelihood** | **Posterior** |
| 18 | Low growth | 0.5 | 0.80 | 0.400 | 0.879 |
| 19 | Moderate growth | 0.3 | 0.15 | 0.045 | 0.099 |
| 20 | High growth | 0.2 | 0.05 | 0.010 | 0.022 |
| 21 | | | **Marginal =** | 0.455 | |
| 22 | **Sample Result =** | Forecast moderate growth | | | |
| 23 | **States of Nature** | **Prior** | **Likelihood** | **Prior*Likelihood** | **Posterior** |
| 24 | Low growth | 0.5 | 0.15 | 0.075 | 0.211 |
| 25 | Moderate growth | 0.3 | 0.70 | 0.210 | 0.592 |
| 26 | High growth | 0.2 | 0.35 | 0.070 | 0.197 |
| 27 | | | **Marginal =** | 0.355 | |
| 28 | **Sample Result =** | Forecast high growth | | | |
| 29 | **States of Nature** | **Prior** | **Likelihood** | **Prior*Likelihood** | **Posterior** |
| 30 | Low growth | 0.5 | 0.05 | 0.025 | 0.132 |
| 31 | Moderate growth | 0.3 | 0.15 | 0.045 | 0.237 |
| 32 | High growth | 0.2 | 0.60 | 0.120 | 0.632 |
| 33 | | | **Marginal =** | 0.19 | |


DECISION TREE:
56.95
No Sample
52
Sample
56.95
Forecast low growth
–8.593406593
0.455
Forecast moderate growth
73.35211268
0.355
Forecast high growth
183.2631579
0.19
Medium-scale expansion
52
Large-scale expansion
34
Medium-scale expansion
–8.593406593
Large-scale expansion
–85.40659341
Medium-scale expansion
68.70422535
Large-scale expansion
73.35211268
Medium-scale expansion
102.7368421
Large-scale expansion
183.2631579
Low growth
0.5000
Moderate growth
0.3000
High growth
0.2000
Low growth
0.5000
Moderate growth
0.3000
High growth
0.2000
Low growth
0.8791
Moderate growth
0.0989
High growth
0.0220
Low growth
0.8791
Moderate growth
0.0989
High growth
0.0220
Low growth
0.2113
Moderate growth
0.5915
High growth
0.1972
Low growth
0.2113
Moderate growth
0.5915
High growth
0.1972
Low growth
0.1316
Moderate growth
0.2368
High growth
0.6316
Low growth
0.1316
Moderate growth
0.2368
High growth
0.6316
–10
90
150
–100
80
300
–22
78
138
–112
68
288
–22
78
138
–112
68
288
–22
78
138
–112
68
288