1. Copy and paste all necessary data from Excel into this document and create tables as needed.
2. For problem 6 part b, the corresponding Excel workbook should be submitted as a second attachment along with the completed Word document.

**Problem 1**

Suppose a manufacturing company makes a certain item. The time to produce each item is normally distributed around a mean of 157 minutes with a standard deviation of 46 minutes.

1. What proportion of the items will take more than 2 hours to make?
2. What proportion of the items will take between 160 and 200 minutes to make?

**Problem 2**

The average prices for a product in 12 stores in a city are shown below.

$2.99, $2.15, $3.25, $3.55, $3.00, $2.99, $2.66, $3.50, $3.20, $2.15, $3.75, $3.85

Test the hypothesis that the average price is higher than $2.57. Use level of significance α = 0.05.

**Problem 3**

A store wishes to predict net profit as a function of sales for the next year. The following table gives the years 1998 to 2005.

|  |  |  |
| --- | --- | --- |
| **Year** | **Sales**  **(thousands of dollars)** | **Net Profit** |
| 1998 | 51 | 7 |
| 1999 | 55 | 9.2 |
| 2000 | 65 | 9.6 |
| 2001 | 82 | -3 |
| 2002 | 75 | 2.5 |
| 2003 | 71 | 3.2 |
| 2004 | 82 | -2.3 |
| 2005 | 81 | -2.6 |

1. Graph the points from 1998 through 2005 on a scatter diagram using Sales as the independent variable and Net Profit as the dependent variable.
2. Draw the regression line on the graph you constructed in Part (a).
3. What is the value of the coefficient of determination for this regression model? Comment on the strength of the regression line for this model.
4. What is the predicted net profit for 2006 if sales are expected to be 105?

**Problem 4**

Last week’s sales of iMac computers at an Apple Store in Oklahoma City, OK, are shown in the following table:

|  |  |
| --- | --- |
| **Day** | **Sales (Dollars)** |
| 1 | 160 |
| 2 | 150 |
| 3 | 200 |
| 4 | 215 |
| 5 | 195 |
| 6 | 205 |
| 7 | 220 |

1. Use the exponential smoothing with α = 0.25 to predict the most immediate future sales.
2. Use the 3-day weighted moving average method for forecasting days 4–7. Use Weight 1 day ago = 3, Weight 2 days ago = 5, and Weight 3 days ago = 2.
3. Compare the techniques using the mean absolute deviation (MAD).

**Problem 5**

The following table shows six years of average annual cost-of-living index data:

|  |  |
| --- | --- |
| **Year** | **Annual Cost of Living Index** |
| 2008 | 102.8 |
| 2009 | 101.4 |
| 2010 | 111.9 |
| 2011 | 124.3 |
| 2012 | 138.6 |
| 2013 | 135.2 |

1. Forecast the average annual food price index for all years from 2008 to 2013. Use a 3-year weighted moving average with weights of 0.6, 0.3, and 0.1. Use the largest weight with the most recent data.
2. Forecast the average annual food price index using exponential smoothing with α = 0.4 for all years from 2008 to 2014. Use the rate for 2008 as the starting forecast for 2008.
3. Which of the methods in parts (a) and (b) produces better forecasts for the 3 years from 2011 to 2013? Answer on the basis of mean square error (MAD).

**Problem 6**

A company manufactures two products, Product A and Product B. The wholesale price and manufacturing cost of each product are shown below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **Price** | **Cost** | **Assembly Times (hr)** |
| **A** | $70 | $10 | 10 |
| **B** | $70 | $20 | 5 |

The company will produce a minimum of 2,000 units of type A and 5000 units of type B. Suppose the company has a budget of $200,000 and 80,000 hours of assembly time available.

1. How many of each item should it produce in order to maximize profits while meeting all necessary constraints? Give the LP model and use the graphical method to find the optimal solution.

**Final Solution:**

**Number of units of item A: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Number of units of item B: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**The Maximum Profit: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**\_

1. Solve the problem by using the Excel Solver. Then without solving the problem again, use the Excel reports to answer the following question. You must state exactly what portion of the Excel reports you have used.

If an additional 4000 hours are added to the assembly line, how much will the optimal profit increase as a consequence?

**Problem 7**

A commercial real estate company is evaluating a proposed warehouse. The proposed site is near a rail terminal, but the state government may extend the highway to the area. In addition, the federal government is considering rebuilding the local port facilities. Below is the payoff table in monthly profit depending upon what government actions are taken. Based on the following criteria, what are the correct choices for terminal rental?

1. Equally likely or principle of insufficient reason criterion
2. Minimax Regret criterion
3. Find the EVPI (The expected value of perfect information). Use equal probabilities for the states.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Warehouse size (ft2)** | **Development projects** | | | |
| **Rail terminal only** | **Highway expansion** | **Port rehabilitation** | **All** |
| **15000** | 10 | 25 | 35 | 40 |
| **30000** | 15 | 25 | 40 | 50 |
| **60000** | 20 | 30 | 45 | 75 |
| **100000** | 15 | 20 | 40 | 90 |