**Homework 01.**

In this assignment you will get practice using Excel to answer questions about real-world data.

**Assigned: 22 August 2017**

**Due: 5:00PM PST, 29 August 2017**

**Instructions: There are ten multiple choice questions. To receive credit, EMAIL your solution by the deadline to** [**tony\_statman@yahoo.com**](mailto:tony_statman@yahoo.com) **according to the following instructions:**

* The SUBJECT LINE must be “DSO545 **HW01 for [Last name, First name] –** “ and then the ten letters corresponding to your answers; so, for example, if your name were John Doe, and you believed the answers were ABCCDCABED, then the subject line of the email must be “DSO545 HW01 for **Doe, John - ABCCDCABED**”
  + The first six characters (DSO545) do not have a space between “DSO” and “545”
  + The ten characters of your answer should have no spaces in between
  + If you submit less than 10 letters, it is assumed that the first letter corresponds to your answer to the first question, etc.
* The FIRST LINE of the body of the email should be your last name, your first name, and your student ID
* The SECOND LINE of the body of the email should be five letters, corresponding to the answers to the five questions (make sure your answer consists of five characters)

**For example, a typical email might be**

From: John Doe <john.doe@usc.edu>

To: tony\_statman <tony\_statman@yahoo.com>

Subject: DSO545 HW01 for Doe, John - ABCCDCABED

DOE, JOHN 123456789  
ABCCDCABED

Daily return on the S&P500 are available for 66.0 years (16,610 trading days) from 1/2/1951 to 12/30/2016. For example, on 1/2/1951, the stock market’s closing value was 1.66% higher than the closing value on 1/2/1951.

1. Between 1/2/1951 to 12/30/2016, which year had the largest number of days showing an increase? [HINT: begin by defining a column of 0’s and 1’s, based on whether a day was an “up” or not.]

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. 1954 | 1. 1964 | 1. 1971 | 1. 1995 | 1. 2004 |

The **Compound Annual Growth Rate (CAGR)** is defined as the rate an investment would have grown if it grew at a steady rate. CAGR can be calculated in either of two equivalent ways:

CAGR = [ (1+change1)(1+change2) … (1+changen)](1 / number of years) – 1

= [ (ending balance) / (starting balance)](1 / number of years) – 1

1. What was the CAGR for the S&P500 for this 66.0 year period?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. 3.3% | 1. 7.4% | 1. 9.6% | 1. 8.3% | 1. 6.4% |

A **run** is a series of stock market moves in a particular direction. An **up run** is a series of consecutive days where the stock market closes higher than the day before. For example, on each of 1/15/1951, 1/16/1951, and 1/17/1951, the stock market’s closing value was higher than the closing value of the day before; but on 1/18/1951 the stock market’s closing value was less than the closing value on 1/17/1951. The days “1/15/1951, 1/16/1951, and 1/17/1951” are an “up run of length 3”.

1. Between 1/2/1951 to 12/30/2016, which year had the longest “up run”?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. 1954 | 1. 1964 | 1. 1971 | 1. 1995 | 1. 2010 |

1. How many “up runs” were exactly 3 days long?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. 589 | 1. 659 | 1. 983 | 1. 1248 | 1. 348 |

Some years, like 1951, showed a net increase in the value of the S&P500: $100 invested at the start of 1951 would have led to an end-of-year balance of $116.35. Other years, like 1953, resulted in a net decrease in the value of the S&P500: $100 invested at the start of 1953 would have led to an end-of-year balance of $93.38.

1. How many of the 66 years showed a net increase in the value of the S&P500?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. 40 | 1. 48 | 1. 49 | 1. 52 | 1. 55 |

When airbags in cars deploy, they fill at a certain “operating pressure”; for this exercise, assume that operating pressure is equivalent to 62.23 megapascals (MPa). Each airbag has a limit as to how much pressure it can take before rupturing; this limit is the airbag’s “hydroburst pressure.” When an airbag deploys, if the operating pressure exceeds the hydroburst pressure, the airbag will rupture, causing injury or even death (assume that, if the operating pressure exceeds the hydroburst pressure by 3.0 MPa, an airbag deployment would be fatal).

In 2015, Takata Corp. reported hydroburst pressure values for ten of its airbags. The reported hydroburst pressure results (expressed in megapascals) are below:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 79.8 | 81.4 | 78.2 | 80.8 | 78.4 | 79.8 | 79.8 | 80.4 | 78.8 | 80.4 |

1. Compute the average and the standard deviation of the 10 reported values. Assuming that hydroburst pressures of Takata airbags follow a normal distribution with the correctly-calculated mean and standard deviation, what is the appropriate Z-value for the operating pressure? Choose the answer that is closest to correct.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. 16.726 | 1. 4.09 | 1. –12.9 | 1. 1.28 | 1. –17 |

1. Based on the reported values, would it be reasonable to allow the use of ~65 million Takata airbags? Choose the best answer.
   1. Yes, because the Z value for the calculated risk is very low.
   2. No, because there is a non-zero chance of injury or even death.
   3. No, because different airbags have different hydroburst pressures, so some might be below the operating pressure.
   4. Yes, because the maximum of the 10 values was much larger than 62.33 MPa.
   5. Yes, because the median of the 10 values was much larger than 62.33 MPa.

It turns out that three of the report data points were fabricated. The actual data for the 10 hydroburst pressure tests are given below (with the replaced values are in **bold**).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **83.9** | 81.4 | 78.2 | 80.8 | **68.4** | 79.8 | 79.8 | 80.4 | 78.8 | **85.9** |

1. What was the most significant effect of altering the data?
   1. The altered data understated the true value of the median
   2. The altered data overstated the true value of the mean
   3. The altered data underestimated the true value of the standard deviation
   4. The altered data made the data appear to be more skewed than they were
   5. The altered data underestimated the maximum possible value for hydroburst pressure
2. Based on the corrected data, and assuming that hydroburst pressure for airbags follows a normal distribution with the correctly-calculated mean and standard deviation, would it be reasonable to allow the use of ~65 million Takata airbags? Choose the best answer.
   1. Yes, because the “operating pressure” is more than 3 SD’s below the mean
   2. No, because the expected number of injuries is too high
   3. Yes, because no test value was as low as the operating pressure of 62.23 MPa
   4. No, because a sample of size 10 can never show safety margin
   5. Yes, because more than half of the “hydroburst pressure” values exceeded 80
3. Based on the corrected data, and assuming that hydroburst pressure for airbags follows a normal distribution with the correctly-calculated mean and standard deviation, what is the maximum allowable operating pressure to ensure that risk of injury is less than 1 in a billion (i.e., less than 10–9)? Choose the answer closest to correct.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. 107.4 MPa | 1. 52.1 MPa | 1. 53.9 MPa | 1. 55.8 MPa | 1. 57.8 MPa |