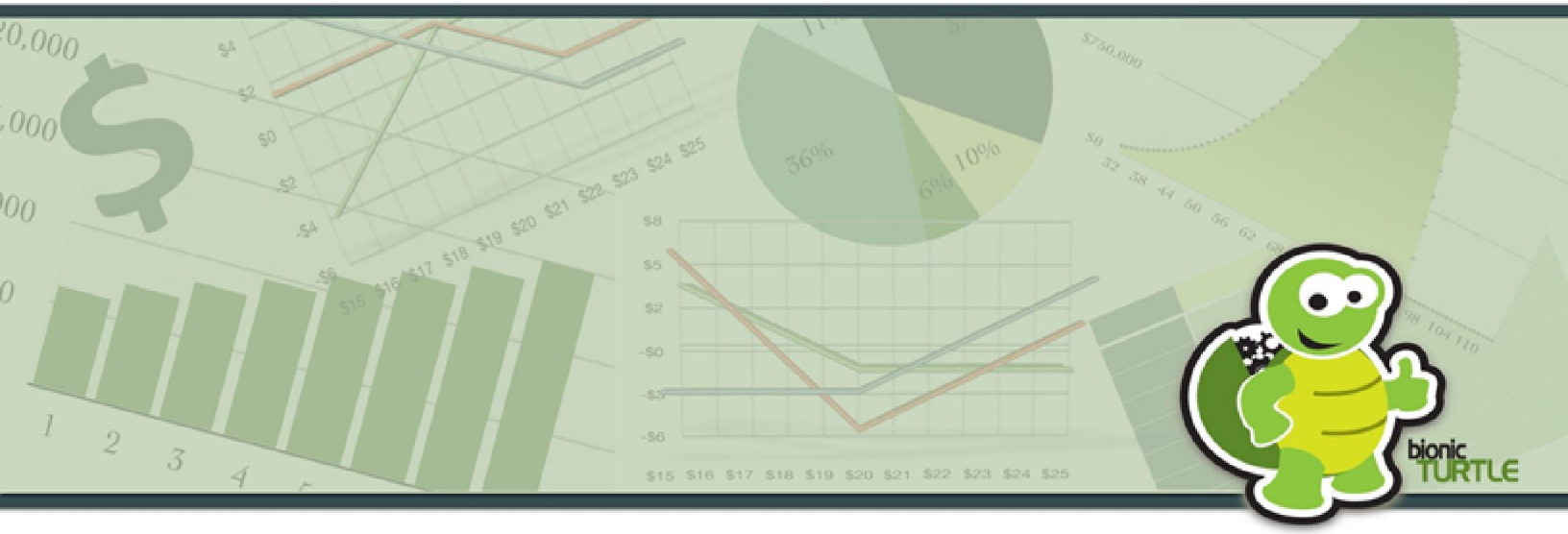

P1.T2. Quantitative Analysis

Bionic Turtle FRM Practice Questions

Chapter 6: Hypothesis Testing

This is a super-collection of quantitative practice questions. It represents several years of cumulative history mapped to the current reading. Previous readings include Miller, Stock, and Gujarti, which we have retained in this practice question set.

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Note that this pertains to Chapters 1-6 in Topic 2, Quantitative Analysis. We will include this introduction in each of those practice question sets for reference.
Within each chapter, our practice questions are sequenced in *reverse chronological order* (appearing first are the questions written most recently). For example, consider Miller's Chapter 2 (Probabilities), you will notice there are fully three (3) sets of questions:

- Questions T2.708 to 709 (Miller Chapter 2) were written in 2017. The **7**XX denotes 2017.
- Questions T2.300 to 301 (Miller Chapter 2 were written in 2013. The **3**XX denotes 2103.
- Questions T2.201 to 207 (Stock & Watson) were written in 2012. Relevant but optional.

The reason we include the prior questions is simple: although the FRM's econometrics readings have churned in recent years (specifically, for Probabilities and Statistics, from Gujarati to Stock and Watson to Miller), the **learning objectives (AIMs) have remain essentially unchanged**. The testable concepts themselves, in this case, are generally quite durable over time. **Therefore, do not feel obligated to review all of the questions in this document!** Rather, consider the additional questions as merely a *supplemental, optional* resource for those who will to spend additional time with the concepts.

The major sections are:

- **Fundamentals of Probabilities (current QA-1, Chapter 1)**
  - Most Recent BT questions, Miller Chapter 2 (T2.708 & T2.709)
  - Previous BT questions, Miller Chapter 2 (T2.300 to T2.301)
  - Previous BT questions, Stock & Watson Chapter 2 (T2.201 to T2.207)

- **Random Variables (current QA-2, Chapter 2)**
  - Most Recent BT questions, Miller Chapter 3 (T2.710 to T2.712)
  - Previous BT questions, Miller Chapter 3 (T2.303 to T2.308)
  - Previous BT questions, Stock & Watson Chapter 3 (T2.208 to T2.213)
  - Previous BT questions, Gujarati (T2.57 to T2.82)

- **Common Univariate Random Variables (current QA-3, Chapter 3)**
  - Most Recent BT questions, Miller Chapter 4 (T2.713 to T2.716)
  - Previous BT questions, Miller Chapter 4 (T2.309 to T2.312)
  - Previous BT questions, Rachev Chapters 2 & 3 (T2.110 to T2.126)

- **Multivariate Random Variables (current QA-4, Chapter 4)**
  - Most Recent BT questions
    - Miller Ch.2 (T2.709)
    - Miller Ch.3 (T2.711)
    - Miller Ch.4 (T2.716)
  - Previous BT questions
    - Miller Ch.2 (T2.301)
    - Miller Chapter 3 (T2.304)
    - Stock & Watson Chapter 2 (T2.201 to T2.202)
    - Stock & Watson Chapter 3 (T2.212 to T2.213)
    - Gujarati (T2.57, T2.58, T2.62, T2.64, T2.65 & T2.67)

- **Sample Moments (current QA-5, Chapter 5)**
  - Most Recent BT questions, Miller Chapter 3 (T2.710 to T2.712)
  - Previous BT questions, Miller Chapter 3 (T2.303 to T2.308)
  - Previous BT questions, Stock & Watson Chapter 3 (T2.212 & T2.213)
  - Previous BT questions, Gujarati (T2.62 to T2.78)

- **This Chapter: Hypothesis Testing & Confidence Intervals (current QA-6, Chapter 6)**
  - Most Recent BT questions, Miller Chapter 7 (T2.718 & T2.719)
  - Previous BT questions, Miller Chapter 5 (T2.313 – T2.315)

- **Appendix**
  - Annotated Gujarati (encompassing, highly relevant)

Hypothesis Testing & Confidence Intervals (Miller Chapter 7)

Appendix: Gujarati: Essentials of Econometrics, 3rd Edition Chapters 1-5

Hypothesis Testing & Confidence Intervals (Miller Chapter 7)

P1.T2.718. Confidence in the mean and variance

Learning objectives: Calculate and interpret the sample mean and sample variance. Construct and interpret a confidence interval. Construct an appropriate null and alternative hypothesis, and calculate an appropriate test statistic.

For the following questions, please feel free to rely on the statistical lookup tables provided here: http://trtl.bz/T2-715-lookup-tables. This document contains four lookup tables (note that each also contains an example): cumulative standard normal distribution, student's t distribution, chi-squared distribution, and F distribution.

718.1. An alternative investments portfolio manager with a very risk trading strategy turns in her first year's (n = 12 months) performance, as displayed below. Her fund's average monthly excess return was +6.083% with volatility (i.e., sample standard deviation) of 15.465%.

If we concede that her true volatility is unknown but we do assume her true returns are normal (note: true is a synonym for population), then what is the probability that her true excess return is greater than zero? (note: inspired by Miller's EOC question 7.1).

a) 17.3%
b) 80.0%
c) 90.0%
d) 91.3%

Month	ER(%)
Jan	-8.0
Feb	11.0
Mar	21.0
Apr	14.0
May	-9.0
Jun	-11.0
Jul	35.0
Aug	23.0
Sep	-6.0
Oct	-12.0
Nov	6.0
Dec	9.0
Avg:	6.083
Sum:	73.000
Sample StdDev	15.465

718.2. You are told that the monthly log returns of a bitcoin index are normally distributed with a standard deviation of 29.0%. You have only 36 months of data, as the index is relatively new, from which you calculate the sample variance. Which is **NEAREST** to the standard deviation of this estimate of the sample variance? (note: variation on Miller's EOC question 7.6).

a) 2.0%
b) 5.0%
c) 10.0%
d) 18.0%

718.3. The promoter of a new cryptocurrency claims that its monthly price volatility is 25.0%, or more specifically, is not greater than 25.0%. The monthly returns for the most recent 36 months are displayed below; the sample volatility is observed to be 32.0%.

	2014	2015	2016
Jan	-34.9%	38.9%	19.3%
Feb	-12.5%	23.0%	57.3%
Mar	-12.1%	31.4%	26.2%
Apr	47.7%	30.3%	60.3%
May	-29.7%	18.3%	-2.5%
Jun	-43.4%	7.0%	21.3%
Jul	-47.4%	30.3%	18.0%
Aug	-41.1%	23.7%	-7.6%
Sep	-51.8%	-1.6%	15.0%
Oct	48.2%	29.6%	15.3%
Nov	16.5%	10.4%	71.2%
Dec	-44.9%	23.0%	11.3%
Sample Standard Deviation			32.0%

Which is **NEAREST** to the probability that the promoter's claim is correct and the true price volatility of the cryptocurrency is less than or equal to 25.0%?

a) About 1.0%
b) About 5.0%
c) About 11.3%
d) About 20.0%

Answers:

718.1. C. 90.0%

The test statistic is given by (6.083 - 0)/[15.465/sqrt(12)] = 1.363. For 11 degrees of freedom, this value happens to displayed on the column at 1-tail = 0.100, such that the one-tailed probability here is 10.0%. Similarly, T.DIST.RT(1.363, 11) = 0.10013. This is the p-value such that we can reject the one-sided null with (100% - p) or 90.0% confidence, in favor of a one-sided alternative hypothesis that finds the true excess return is greater than zero.

718.2. A. 2.0%. Per Miller's formula 7.5, the expected variance of the sample variance is given by σ^4*2/(n-1) when the distribution is normal (i.e., excess kurtosis equals zero); in this case, expected variance = 0.290^4*2/35 = 0.00040416 and the expected standard deviation equals sqrt(0.00040416) = 2.0104%

718.3. A. About 1.0%. The critical chi-squared value is given by S^2/σ^2*df; in this case, chi-squared = 0.320^2/0.250^2*(36-1) = 57.43. For 35 degrees of freedom, this value corresponds to the one-sided p-value; i.e., we would reject the null with 99.0% confidence.

Discuss here in forum: https://www.bionicturtle.com/forum/threads/p1-t2-718-confidence-in-the-mean-and-variance-miller-ch-7.13391/