

AGEC 622
09_multivariate_normal Exercises
Due before the beginning of the next class

- Complete the exercises in the notebook “09_exercises_LASTNAME_FIRSTNAME.xlsx”.
- **Rename your file, replacing ”LASTNAME_FIRSTNAME” with your actual names.**
- If there is more than one question, note that each should have its own tab in the workbook.
- **Work vertically down the sheet** within your notebook. Separate the individual parts of the question(s) (a, b, c, . . .) using dividing rows like the blue example dividers in the file.
- Submit this homework by emailing your xlsx file to henry@tamu.edu, **with the subject “AGEC 622 exercises 09”**.

1) **Question 1**

The overall objective of this question is to repeat the analysis from the 07 and 08 exercises, but using the multivariate normal joint probability distribution for simulating the four underlying stochastic variables.

- a) **Build a model for the crop price.** Repeat step a) from the 07_exercises, but do not yet generate the stochastic residuals/errors/innovations or the forecasts.
- b) **Build a model for the crop yield.** Repeat step b) from the 07_exercises, but do not yet generate the stochastic residuals/errors/innovations or the forecasts.
- c) **Build a model the gasoline price.** Repeat step c) from the 07_exercises, but do not yet generate the stochastic residuals/errors/innovations or the forecasts.
- d) **Build a model for variable cost (VC).** Repeat step d) from the 07_exercises, but do not yet generate the stochastic residuals/errors/innovations or the forecasts.
- e) **Jointly generate all stochastic variables.**
 - Collect all of the recovered historical residuals/errors/innovations from parts a) through d) together in four columns. Calculate a vector of means for the four series. Calculate the sample covariance matrix for the range of dates where there are observations for all four series.
 - Simulate these four series for 2019 through 2023 using the multivariate normal distribution.
 - Use the simulated residuals/errors/innovations to generate stochastic forecasts for the crop price, crop yield, gasoline price, and variable costs for 2019 through 2023.
- f) **Calculate financial variables for the enterprise.** Calculate NR and ending cash (beginning cash + NR) for each year for 2019 through 2023, following the approach and parameters for this purpose from the 07_exercises.
- g) **Simulate NR and ending cash.**

Determine the following values:

 - Expected ending (2023) cash
 - The probability ending (2023) cash is less than \$0
 - The probability ending (2023) cash is less than \$100,000
- h) **Interpret.**
 - What differences in the results do you find?
 - Do you have more confidence in these results or those from the 07 or 08 exercises?
 - What problems, if any, do see with the revised model/analysis?