Economics 250 — Exercise 3 **Not to be handed in!**

The following are relevant practice problems, mostly chosen from the textbook, to help you study for the final exam.

You are encouraged to attempt to answer the questions using just the course formula sheet, z tables, and t table, and your calculator—the same material you will have for the exam. You can download copies of the formula sheet and tables from the course webpage under "Resources".

Note that these questions—deliberately—do not have answers in the end of the textbook. For the most part, you should get to the point where you are comfortable and confident in being able to answer these sorts of questions (after all, you will have no answer to check when writing the exam!). If you do struggle with figuring out how to do some question, bring your questions to the help session on Wednesday (December 7th), or otherwise get in touch with the professor or one of the TAs: we are here to help!

Questions:

- Chapter 1:
  - 1.76 (a) *(p. 40; mean and standard deviation)*
  - 1.78 *(p. 43; skewness)*
  - 1.80 (a,b,d,e) *(p. 44; uniform distribution probabilities)*
  - 1.112 *(p. 62; normal distribution probabilities)*
- Chapter 2:
  - 2.32 (a,c) *(p. 97; correlation)*
  - 2.118 (a,b) *(p. 132; two-way tables and conditional distributions)*
- Chapter 3:
  - 3.62 *(p. 184; experimental design)*
  - 3.70 *(p. 184; randomness)*
- Chapter 4:
  - 4.32 *(p. 235; discrete random variables)*
  - 4.44 *(p. 237; discrete random variables and roulette)*
  - 4.92 *(p. 261; adding random variables)*
  - 4.140 *(p. 281; normal and sample mean statistics)*
- Chapter 5:
  - 5.14 *(p. 293; probabilities. You could use a binomial probability calculation here, but you don't need to.)*

  - 5.28 *(p. 299; conditional probabilities and independence)*
  - 5.46 *(p. 304; conditional probabilities leading up to Bayes' rule. Consider the question's statement "(Draw a tree diagram.)" as only a suggestion: draw one if it helps you, but feel free to not draw a tree diagram)*
  - 5.48 *(p. 304; continues 5.46: Bayes' rule)*
  - 5.72 *(p. 317; binomial probabilities)*
- Chapter 6:
  - 6.16 *(p. 349; confidence interval with σ known.* ***Hint:*** *$\overline{x} = 28.8$)*
  - 6.54 *(p. 367; p-values)*
  - 6.60 *(p. 368; stating hypotheses)*
  - 6.68 *(p. 369; hypothesis testing with σ known)*
- Chapter 7:
  - 7.20 (a,b,c,d) *(p. 413; t test)*
  - 7.22 *(p. 413; critical values)*
  - 7.24 *(p. 414; significance testing; related to 6.16, above: $\overline{x} = 28.8, s_x^2 = 47.519$)*
  - 7.56 *(p. 418; sign test)*
  - 7.74 *(p. 435; comparing means)*
- Chapter 8:
  - 8.18 *(p. 469; proportion confidence interval)*
  - 8.44 *(p. 471; proportion hypothesis testing)*
  - 8.76 *(p. 484; proportion equality testing)*
- Sample regression question:

  Consider the linear regression model:

  $$colGPA = \beta_1 + \beta_2 hsGPA + \beta_3 ACT + u$$

  where $colGPA$ is college GPA, $hsGPA$ is high school GPA, and ACT is a standardized test score for US college entrance (with a range of 1–36).

  The model is estimated with Ordinary Least Squares using data on $n = 141$ students from a large university. The regression software gives the following estimates (with standard errors for the estimates indicated in parentheses):

  $\widehat{\beta}_1 = 1.286 \quad (0.341)$
  $\widehat{\beta}_2 = 0.453 \quad (0.096)$
  $\widehat{\beta}_3 = 0.0094 \quad (0.0108)$

The regression program also reports $R^2 = 0.176$.

a) Find the predicted college GPA for an individual with a high school GPA of 3.1 and an ACT score of 22.

b) Calculate the residual for an individual with the above $hsGPA$ and ACT values who has a college GPA of 2.5.

c) Give an interpretation of $\widehat{\beta}_1$ and $\widehat{\beta}_2$. Are these values meaningful?

d) How much of the sample variation in college GPA can be explained by the variation in high school GPA and ACT scores?

e) Perform a test of the hypothesis that $\beta_2 = 0.25$ against the alternative that $\beta_2 > 0.25$ and calculate a p value range. How many degrees of freedom does your test statistic have? Can you reject the null hypothesis in favour of the alternative at the $\alpha = 0.05$ significance level?