ECO220Y: Homework 9

<u>Note:</u> First do Exercises 1 – 8 on page 4 of "The Normal Table: Read it, Use it" (posted on Quercus).

Required Exercises: <u>Chapter 9:</u> 19, 21, 23, 25**, 27**, 29, 31*, 32*, 39, 65*, 66*, 67**, 69**, 71**, 73**, 75*, 78*, 81*, 99*, 101*, 106*

> * Use the **one-page Normal table** and not a computer or the two-page table at the back of the textbook;
>
> ** Note the instruction to do these particular exercises *without* using tables or computers, but by using the Empirical Rule instead. (This is important in building your conceptual understanding of the Normal distribution.)

Required Problems:

(1) A U of T student gets an internship at Barilla Corporation, which makes pasta products. She learns that while the boxes say the weight of pasta contained within is 454 grams there is actually some variation. For the penne shape – her favourite – she discovers that the mean is actually 458 grams with a standard deviation of 5 grams and the distribution is Normal (Bell shaped). When she gets home she is curious about the boxes she happens to have in her pantry. She carefully weighs the pasta from each using a digital scale.

> **(a)** If she has 1 box in her pantry of Barilla penne pasta, what is the chance that it weighs less than what is indicated on the box (i.e. is underweight)?
>
> **(b)** If she has 4 boxes in her pantry of Barilla penne pasta, what is the chance that at least one of them weighs less than what is indicated on the box?
>
> **(c)** What is the chance that all four boxes contain less than what is indicated on the box?
>
> **(d)** Is she adds up the weight of her four boxes, what is the chance the total is less than 454*4?
>
> **(e)** Suppose she finds three additional boxes deeper in her pantry. What is the chance that the total of all seven boxes is less than 454*7?
>
> **(f)** Write out the final answers for parts **(a)**, **(d)** and **(e)** (e.g. P(X1 < 454) = #, …). Why aren't the answers to **(a)**, **(d)** and **(e)** the same? Explain.

(2) In a survey of adult GTA residents one question asks "Do you support Mayor John Tory? Yes or No." For all parts below suppose that in truth exactly 60% of the entire adult population of GTA residents support Tory.

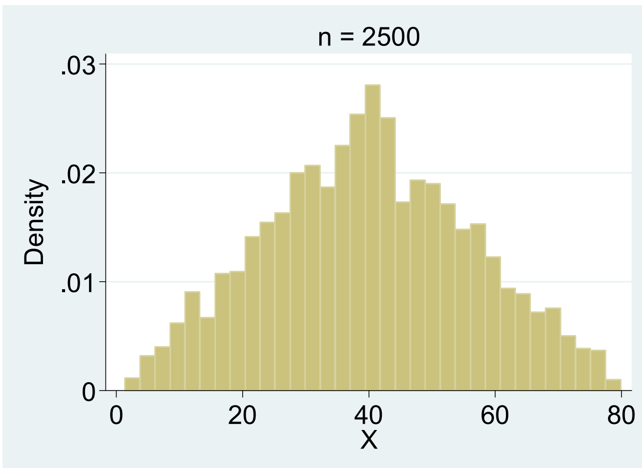
> **(a)** Suppose a random sample of 2,000 Toronto residents is asked the survey question. Draw a *fully labeled graph* of the distribution of the random variable recording the number of people who answer "Yes" to the survey.
>
> **(b)** What is the probability that the percent of the sample supporting Ford is at least 50 percent but not more than 70 percent?
>
> **(c)** Compare and contrast your answers with those to Required Problem 4 in HW 8.

(3) Create an "alternative" Empirical Rule where the percentages are round numbers. Find in the missing values.

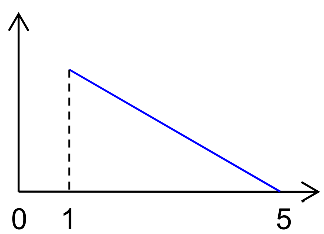
> About 25% of observations are within ± _______ s.d. of mean
> About 50% of observations are within ± _______ s.d. of mean
> About 75% of observations are within ± _______ s.d. of mean

(4) Consider a test that measures adults' memory skills and suppose that scores are bell shaped. You take the test and obtain a score of 254.21 and are told that you are in 96.1th percentile. Your friend also takes the test and obtains a score of 161.42 and is told that he is in the 22.8th percentile. What is overall mean and standard deviation of the test scores? Sketch the distribution and show where you are and where your friend is.

(5) To the nearest integer, find the approximate standard deviation of the following histogram. (Hint: Do <u>not</u> try to use the Empirical Rule or Chebycheff's Theorem. Instead use what you know about a distribution of this shape with the parameters that can be estimated from the graph.)



(6) Consider the following density function. Write the exact density function (i.e. formula for it).



(7) Consider rolling one die and creating a random variable that is the value shown. Find the continuous probability distribution that approximates this discrete probability distribution and give its parameters and sketch it. (Hints: Be careful with the endpoints and make sure that the probabilities you get from your proposed continuous approximation are good approximations (e.g. $P(X = 1) \approx P(0.5 < X < 1.5)$).)