Homework 4

Due: October 8th, 11:59 pm.

Instructions: Please scan or typeset your solutions and upload them as a single pdf file to Canvas. All handwritten parts must be legible. Both, textbook and out-of-textbook problems are mandatory. In each part of OPT1 write down the required probability statement first, and then compute it in R.

Readings: Chapter 5 (Sections 5.1 - 5.5)

Textbook problems:

Section 5.6: 3 (a, b, c, d)
Section 5.6: 7. In addition to computing the probabilities, also express the answers in the standard normal cdf $\Phi(.)$
Section 5.6: 8

Out-of-textbook problems (OTP):

OTP 1. During the pandemic a grocery delivery business started with the policy of delivering orders with a maximum delay of 30 minutes (with respect the desired delivery time picked by customers in their online purchases). Say the delivery delay is preliminary modeled using a $Uniform[0, 30]$-distributed random variable.

a) What is the probability that a (random) order arrives during the last 5 minutes of the 30 minutes time window?

b) Is the probability in (a) the same that the probability that the order arrives in the first 5 minutes (of the 30 minutes time window)?

Say after some months of operation data suggested that a better model for the delivery delay time turned out to be a Normal distribution with mean 18 and standard deviation 6 minutes.

c) What is the probability that the order arrives after the 25th minute of delay?

d) What is the probability that the order arrives before the time picked by the customer?

e) Quantitatively comment on how well the business is doing with respect to its policy.

OTP 2. Draw a graph overlaying the pdfs of $N(0,1), t(3)$, and $t(10)$, and then **comment** comparatively.

OTP 3. Briefly describe the relationships among the following distributions $N(\mu, \sigma^2), N(0,1), \chi^2(n), t(\nu)$, and $F(\nu_1, \nu_2)$.

Problems by learning objectives (plus rubric):

Question	Points	Goal: to reinforce...
5.6.3	4 pt	pdf definition, expectation and variance in continuous case
5.6.7	5 pt	Normal distribution manipulation
5.6.8	5 pt	properties of expectation and variance in continuous case
OTP1	5 pt	continuous distributions application
OTP2	4 pt	pdf visualization and description
OTP3	4 pt	distributions derived from the Normal distribution
	27 pts.	