STAT 435
Spring 2024

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Lab Assignment 7 (*20 points*)

Notes: ~~~~~~

- Create a new folder on your desktop and name it **LA7_*your name***. Set this as your working directory in RStudio.
- **Open a blank Word document** and save it as **LA7_Word_*your name*.docx**.
- In RStudio, open a blank source file (R Script) to work in, and make sure all History entries are cleared before you start your work on the following questions.
- In the R Script, add *Lab Assignment-7 (by **your name**)* as a comment line, and clearly label your answer to each question and part.
- When recreating a plot, you will be graded on how accurate your recreation is. If you cannot recreate an aspect, submit your best approximation to be graded.

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Report the values you get from R, do not round them.
You can easily copy the values from the R Console and paste it into this PDF file.

1. For $X \sim Bin(n = 20, p = 0.73)$

   a) Find $P(X = 15) =$ 0.1982008

   b) Create a probability distribution plot of X. Copy your graph into your Word file.

   c) Find $P(10 < X < 15) =$ 0.440498

   d) Find $P(14 \leq X < 18) =$ 0.4721953

   e) Find $P(X > 12) =$ 0.8545463

   f) Find x such that $P(X > x) = 0.4$. $x =$ 14

   g) Find the mean and the standard deviation of X.

   $\mu =$ 14.6 , $\sigma =$ 1.985447
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2. For $X \sim N(\mu = 20, \sigma = 3)$,

   a) Find $f(x = 18)$ = 0.1064827

   b) Draw probability density curve of X over the range from 10 to 30.
   Have "Density Curve of $X \sim$ N(μ = 20, σ = 3)" as the title to your graph. Copy your graph into your Word file.

   c) Find $P(X > 23)$ = 0.1586553

   d) Find $P(12 \leq X < 21)$ = 0.6267283

   e) Find the 70th percentile of X: 21.5732

   f) Find a and b such that $P(a \leq X \leq b) = 0.8$ (central area).

   a = 16.15535 , b = 23.84465

   g) Find the quintiles of X distribution and report them below:

   17.47514 19.23996 20.76004 22.52486

   h) Find the IQR of X: 4.046939

   i) Set the seed to 435 and then generate a random sample of size of 1000 from X distribution, summarize the random sample graphically and numerically. (*Hint: You may use the mean and the standard deviation as the numerical summary, and a histogram as a graphical summary*.)

   Does the sample resemble the population? Why or why not? Briefly explain below:

   Mean: 20.08021. This is close to 20, which is the original value of the distribution.

   STDev: 2.994848. This is close to 3, which was the original value of the distribution.

   The histogram of the random sample resembles a bell curve where the highest probabilities are in the middle (around X = 20)

3. Let the random variable X be the time between the moment the IRS receives your tax return forms and the moment you receive your tax refund. It is known that X follows a uniform distribution over the interval from 2.1 to 10.5 weeks.

   a) Suppose you are waiting for your federal tax refund. What is the probability that you have to wait more than 3.5 weeks before receiving your refund? 0.8809524

   b) What is the probability that you will receive your refund in under a month? 0.2772109

c) What is the probability that you have to wait between 4 and 6 weeks before receiving your refund? 0.2380952

d) What value of X separates the longest 5% of the times from the remaining? 10.08

e) Find the mean and the standard deviation of X.

$\mu =$ 6.3 , $\sigma =$ 2.424871

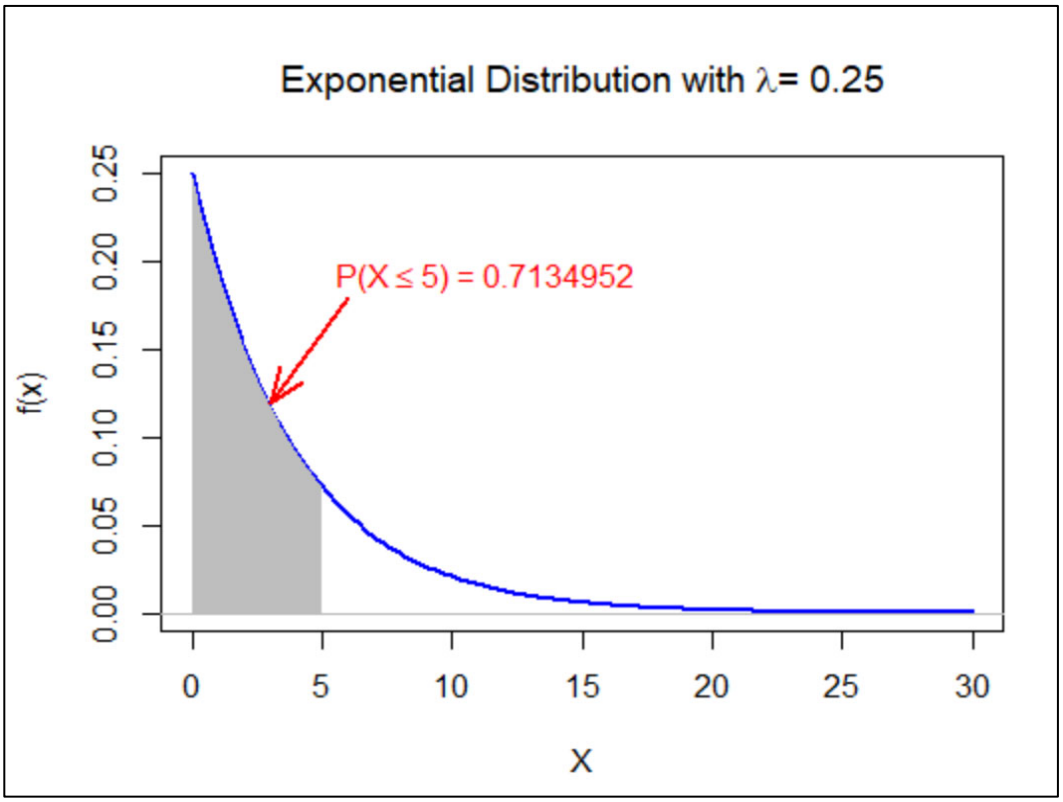
4. A catalyst researcher states that X, the diameters (in microns) of the pores in a new product he has, follows an exponential distribution with $\lambda = 0.25$.

a) Find $P(X > 7) =$ 0.8262261

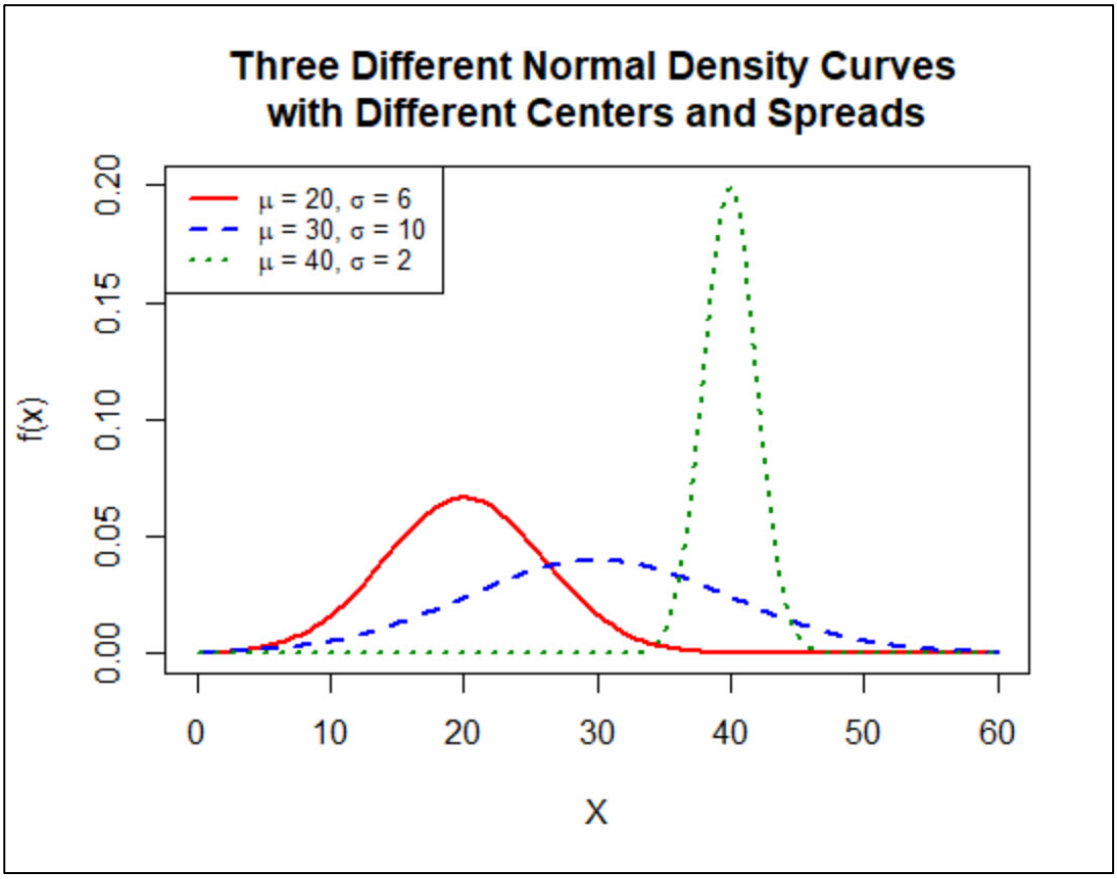
b) Find $P(5 \leq X < 20) =$ 0.2797668

c) Find the 90th percentile of X: 9.21034

d) Find $P(X \leq 5)$ and then determine the command(s) that will recreate the following graph. Copy your graph into your Word file.



5. Determine the commands that will recreate the following graph which compares three different normal distributions in terms of their centers and spreads. Then, copy your graph into your Word file.



Save your RScript naming it **RScript_*your name***.
Save your Word document.

Then, email the files **RScript_*your name***, **LA7_Word_*your name*.docx**, and this lab assignment file (with the blanks filled in and saved) to the professor at sgazioglu@mtech.edu

Have '**Stat435 – LA7**' in the subject line of the e-mail.