

Math 152 - Statistical Theory - Homework 1

write your name here

Due: Friday, August 28, 5pm PDT

Important Note:

You should work to turn in assignments that are clear, communicative, and concise. Part of what you need to do is not print pages and pages of output. Additionally, you should remove these exact sentences and the information about HW scoring below.

Click on the *Knit to PDF* icon at the top of R Studio to run the R code and create a PDF document simultaneously. [PDF will only work if either (1) you are using R on the network, or (2) you have LaTeX installed on your computer. Lightweight LaTeX installation here: <https://yihui.name/tinytex/>]

Either use the college's RStudio server (<https://rstudio.pomona.edu/>) or install R and R Studio on to your personal computer. See: <https://research.pomona.edu/johardin/math152f20/> for resources.

General notes on homework assignments (also see syllabus for policies and suggestions):

- please be neat and organized, this will help me, the grader, and you (in the future) to follow your work.
- be sure to include your name on your assignment
- it is strongly recommended that you start / write out the questions as soon as you get the assignment. This will help you to start thinking how to solve them!
- for R problems, it is required to use R Markdown
- in case of questions, or if you get stuck please don't hesitate to email me **and** use Discord for questions!!

Homework assignments will be graded out of 5 points, which are based on a combination of accuracy and effort. Below are rough guidelines for grading.

- **5** All problems completed with detailed solutions provided and 75% or more of the problems are fully correct.
- **4** All problems completed with detailed solutions and 50-75% correct; OR close to all problems completed and 75%-100% correct
- **3** Close to all problems completed with less than 75% correct
- **2** More than half but fewer than all problems completed and $> 75\%$ correct
- **1** More than half but fewer than all problems completed and $< 75\%$ correct; OR less than half of problems completed
- **0** No work submitted, OR half or less than half of the problems submitted and without any detail/work shown to explain the solutions.

Assignment

You might be interested in these resources:

- Probability distribution demos: ISLE widgets
- Fantastic cheat sheet for Univariate Distributions created by Lindsey Leemis

1: PodQ

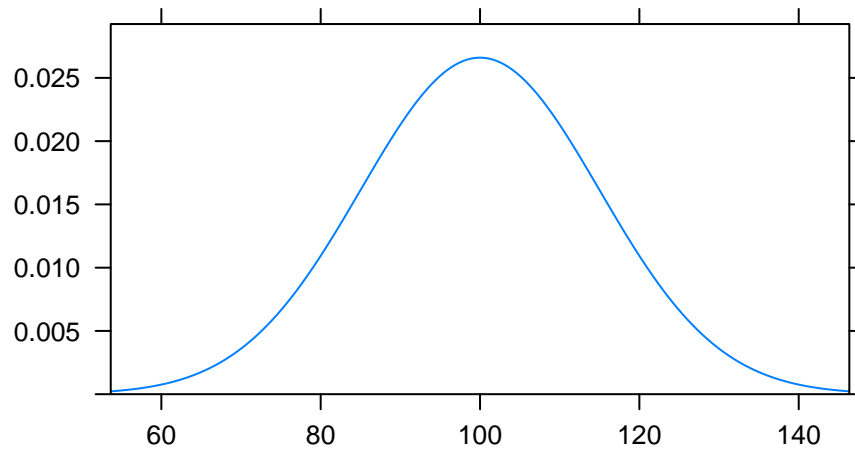
Describe one thing you learned from someone in your pod this week (it could be: content, logistical help, background material, R information, etc.) 1-3 sentences.

2: R - code provided, use help()

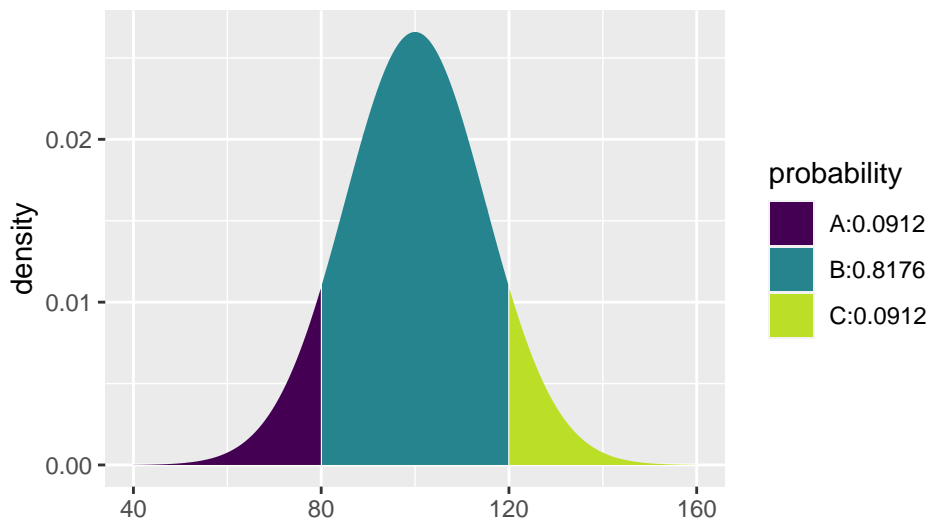
Children's IQ scores are normally distributed with a mean of 100 and a standard deviation of 15. One might, for example, be interested in the proportion of children having an IQ between 80 and 120. One might also randomly generate 47 students from such a population and create a histogram.

```
set.seed(47) # to set the randomness
```

```
plotDist('norm', mean = 100, sd = 15)
```



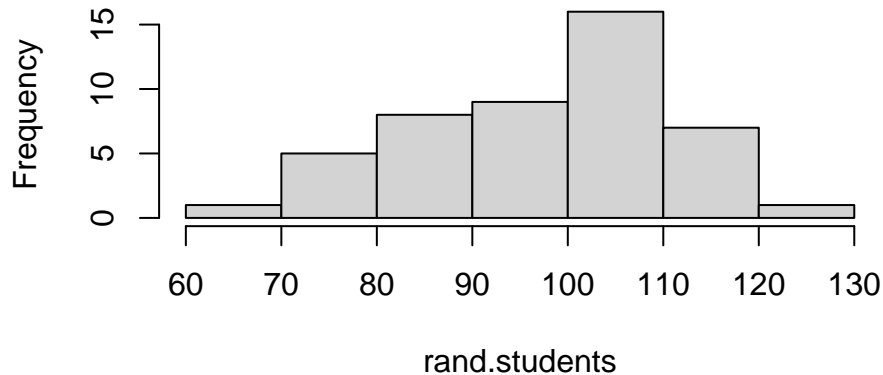
```
xpnorm(c(80, 120), mean = 100, sd = 15)
```



```
## [1] 0.09121122 0.90878878
```

```
rand.students = rnorm(47, mean = 100, sd = 15)  
hist(rand.students)
```

Histogram of rand.students



```
mean(rand.students)
```

```
## [1] 97.34426
```

```
var(rand.students)
```

```
## [1] 182.326
```

```
sd(rand.students)
```

```
## [1] 13.50282
```

- The R function `dnorm()` gives the height of the density (i.e., $f(x)$, the pdf). What is a density?
- The R function `pnorm()` gives the area associated with the density. What is the area associated with the density? [Note that the expanded function `xpnorm()` which is available in the `mosaic` package includes pictures with the associated areas.]
- Look up the R function `qnorm()`. What does `qnorm()` provide? [Note that the expanded function `xqnorm()` which is available in the `mosaic` package includes pictures with the associated quantiles.]
- Look up the R function `rnorm()`. What does `rnorm()` provide?

3: R - simulating data

Consider the beta distribution (Google it if you are unfamiliar with it).

- Provide the pdf for any *symmetric* beta distribution (specify a and b which should not equal to 1).
 - What are the theoretical mean, variance, and standard deviation of your beta distribution? (not found using R)
 - Using the R function `rbeta()`, generate 100 random beta variates, and make a histogram of the random sample.
 - Find the sample mean, sample variance, and sample standard deviation of your 100 random deviates.
 - plot the density (pdf); use `plotDist()`
- Provide the pdf for any **non-symmetric** beta distribution (specify a and b).
 - What are the theoretical mean, variance, and standard deviation of the beta distribution? (not found using R)
 - Using the R function `rbeta()`, generate 100 random beta variates, and make a histogram.
 - Find the sample mean, sample variance, and sample standard deviation of your 100 random deviates.
 - plot the density (pdf)