STA511 Homework #1

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1. No materials need to be submitted for this problem.

2. Problem 2, has multiple parts.

   (a) 1000 random samples from $X \sim U(0,1)$ is simulated. Simulated samples were then used to produce $Y = \pi X - \frac{\pi}{4}$. Histograms of $X \sim U(0,1)$ and $Y = \pi X - \frac{\pi}{4}$ were produced using R and presented below.

```
x <- runif(1000,0,1)
y <- x*pi-(pi/4)

par(mfrow=c(1,2), bg="gray95")
hist(x, breaks=50,main="Histogram of X", xlab="Random Variables", ylim=c(0,30))
hist(y, breaks = 50,main="Histogram of Y", xlab="Random Variables",ylim=c(0,30))
```

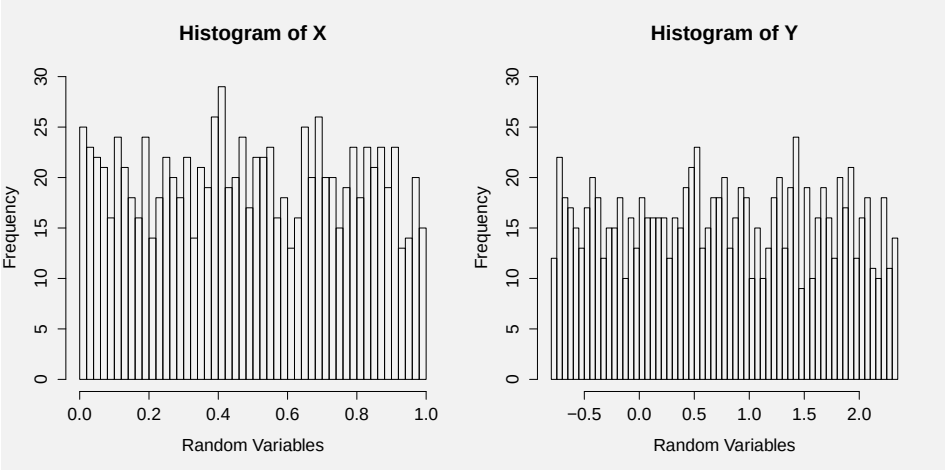

Figure 1: Histograms of $X \sim U(0,1)$ and $Y = \pi X - \frac{\pi}{4}$

   (b) From looking at the histogram for Y, the theoretical distribution for Y is likely to be uniform.

   (c) 1000 random samples from another uniform distribution, $Z \sim U(0,1)$ is simulated. Simulated samples were then used to add to 1000 random samples generated from X. Histogram of $X + Z$ is then produced using `R hist()` function and presented below (Figure 2).

   (d) Histogram of $X + Z$ is produced using `R truehist()` function and presented below (Figure 2). It can be seen that the distribution of the `truehist()` is exactly the same to the `hist()` function, however instead of the frequencies of the random variables, probabilities are presented on the y axis.

```
z <- runif(1000,0,1)
xz <- x+z

par(mfrow=c(1,2))
hist(xz,breaks=20, main="Histogram of X+Z", xlab="Random Variables", col="firebrick")
truehist(xz, xlab="Random Variables", main=" True Histogram of X+Z")
```

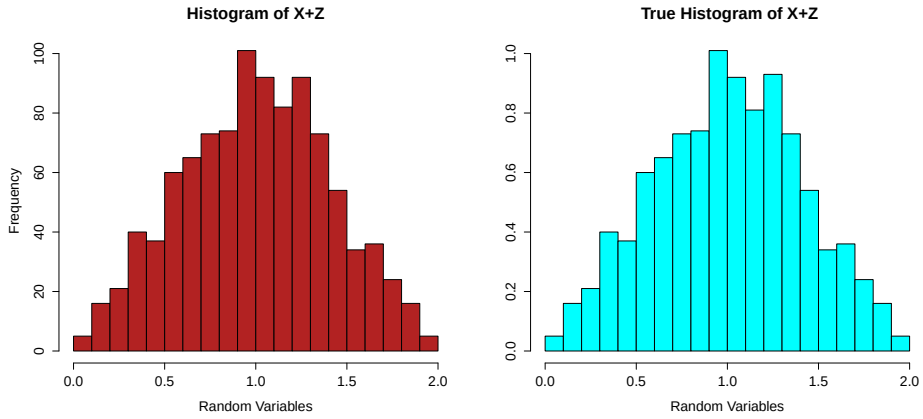

Figure 2: Histogram and true histogram of $X \sim U(0,1) + Z \sim U(0,1)$

(e) Looking at the shape of the histogram, and the symmetry of the both distributions, it is likely that $X + Z$ has a normal distribution.

3. For this problem randomly generated numbers were assigned as numeric grades to each student in the class. Then a letter grade was determined for each student according to the grading scheme given in the problem and added to the data frame. Generated data frame was then printed as a LaTeX compatible table.
The code for this problem is given below:

```
install.packages('xtable')
library(xtable) #package to extract table in LaTeX format
setwd("./Google Drive/Statistical Computing/HW1/")

roster <- read.table("./classlist.txt", header = T, stringsAsFactors = F, sep = "\t")
chrs <- roster$Program.and.Plan
roster$Program.and.Plan <- gsub('.{3}$', '', chrs)
roster$Grade <- sample(60:100, 35, replace=T)
intervals <- cut_interval(roster$Grade, length = 5)
levels(intervals) <- c("C", "C", "C", "B-", "B", "B+", "A-", "A")
roster$Letter_Grade <- intervals
roster.table <- xtable(roster) #extracts table in the LaTeX format to the R console
print(roster.table)
```

Generated table is presented in the next page.

	Name	Program.and.Plan	Level	Grade	Letter_Grade
1	An,Bo	Pharmaceutcl Sci Doctoral	Doctoral 2	77	B-
2	Bu,Yahao	Public Health Masters	Masters 2	100	A
3	Chang,Huiru	Public Health Masters	Masters 2	82	B
4	Chen,Jiangwang	Public Health Masters	Masters 2	82	B
5	Eum,Youngseob	Arts & Sciences Doctoral	Doctoral 1	79	B-
6	Ganley,Kevin	Public Health Masters	Masters 1	100	A
7	Hess,Katelyn	Arts & Sciences Masters	Masters 1	64	C
8	Hsu,En-Shuo	Public Health Masters	Masters 1	67	C
9	Jai Kumar Ahuja,Suruchi	Public Health Masters	Masters 1	66	C
10	Jin,Yuxuan	Public Health Doctoral	Doctoral 1	73	C
11	Karaesmen,Ezgi	Roswell Park Doctoral	Doctoral 2	76	B-
12	Krishnan,Krithika	Public Health Masters	Masters 1	91	A-
13	Lin,Jieya	Public Health Masters	Masters 1	99	A
14	Mandava,Aishwarya	Public Health Masters	Masters 1	81	B
15	Marsales,Harry	Public Health Masters	Masters 2	66	C
16	Morrell,Kayla	Public Health Masters	Masters 1	99	A
17	Niu,Jin	Pharmaceutcl Sci Doctoral	Doctoral 2	97	A
18	Rizvi,Abbas	Roswell Park Doctoral	Doctoral 2	60	C
19	Rosario,Spencer Rae	Roswell Park Doctoral	Doctoral 2	79	B-
20	Schiller,Emily	Public Health Masters	Masters 1	82	B
21	Song,Jiaming	Public Health Masters	Masters 1	97	A
22	Spencer,Mary	Public Health Masters	Masters 1	91	A-
23	Sun,Xiaoxi	Public Health Masters	Masters 1	82	B
24	Tanue,Terence Wankah	Public Health Masters	Masters 1	75	C
25	Tian,Mingmei	Public Health Masters	Masters 2	88	B+
26	Vucic,Luther	Public Health Masters	Masters 1	60	C
27	Wackeroth,Wolf Michael	Public Health Masters	Masters 1	90	B+
28	Wang,Jiefei	Public Health Masters	Masters 1	68	C
29	Wang,Xue	Roswell Park Doctoral	Doctoral 2	80	B-
30	Wu,Yin	Grad Sch of Ed Doctoral	Doctoral 2	64	C
31	Yang,Yang	Grad Sch of Ed Doctoral	Doctoral 2	67	C
32	Yang,Yujie	Pharmaceutcl Sci Doctoral	Doctoral 2	99	A
33	Yang,Zeyu	Public Health Masters	Masters 1	94	A-
34	Yu,Xinyang	Biomedical Sci Doctoral	Doctoral 2	75	C
35	Zhao,Yichen	Grad Sch of Ed Doctoral	Doctoral 2	63	C