Assignment_1

#2

(a)

$$E(Y) = y_1 p_1 + ... + y_k + p_k = \sum_{i=1}^{k} y_i p_i$$

(b)

$$\sigma_Y = Var(Y) = E[(Y - \mu_y)^2] = \int_{i=1}^{k} (y_i - \mu_y)^2 p_i$$

(c)

$$\bar{\beta} = \frac{\int_{i=1}^{n} (y - y_i)(x - x_i)}{\int_{i+1}^{n} (x - x)^2}$$

(d)

$$P(a \leq Y \leq b) = \int_{a}^{b} f_Y(y) dy$$

(e)

$$\hat{g}(x) = \frac{\frac{1}{nh} \int_{i=1}^{n} y_i k(\frac{x_i - x}{h})}{\frac{1}{nh} \int_{i=1}^{n} k(\frac{x_i - x}{h})}$$

$$z_1 = \sqrt{-2ln(\mu_1)}xcos(2\pi\mu_2)$$

$$z_2 = \sqrt{-2ln(\mu_1)}xsin(2\pi\mu_x)$$

$$z = [z_1, z_2]$$

#3.1

(a)

```
n = 1000
```

(b)

```
mu_1 <- runif(n/2,0,1)
mu_2 <- runif(n/2,0,1)
```

(c)

```
z_1 <- sqrt(-2*log(mu_1))*cos(2*pi*mu_2)
z_2 <- sqrt(-2*log(mu_1))*sin(2*pi*mu_2)
```

(d)

```
z <- c(z_1,z_2)
```

(e)

```
mu=5
sigma=2
```

(f)

```
x = mu + sigma * z
```

(g)

```
mean(x)
```

```
[1] 4.962202
```

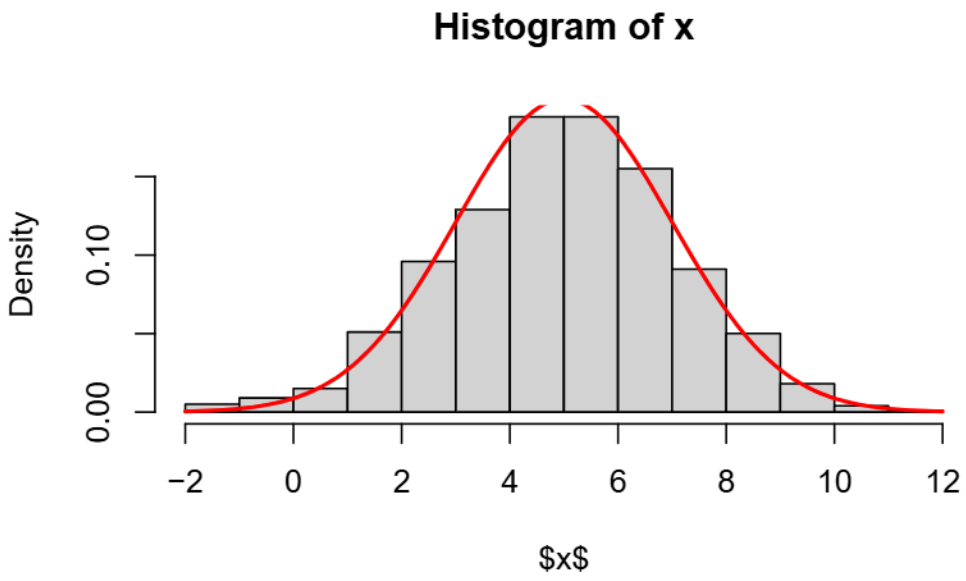
```
sd(x)
```

```
[1] 2.073515
```

(h)

```
hist(x,
freq= FALSE,
ylab= "Density",
xlab= "$x$")

curve(dnorm(x,mean= mu,sd= sigma),
col= "red", lwd= 2,add = TRUE)
```



#3.2

```
cihi <- read.csv("hlthexp.csv")

df <- data.frame(Year = cihi$Year,
                 Hospitals = cihi$Hospitals,
                 Physicians = cihi$Physicians,
                 "Other Services" = cihi$Other.Institutions,
                 Dental = cihi$Other.Professionals..Dental.Services,
                 Vision = cihi$Other.Professionals..Vision.Care.Services,
                 "Other Professionals" = cihi$Other.Professionals..Other.Services,
                 check.names = FALSE)
```

(a) Determine if there are any missing values for the variable Hospitals No missing values number of observations is 48 each has a value

```
df$Hospitals
```

```
 [1]  5136.77  5977.68  6372.73  6861.92  7487.62  8585.16 10127.35 12001.93
 [9] 13174.55 13936.30 14737.75 15937.05 17154.21 18497.17 20268.98 20528.15
[17] 21783.23 22652.40 22619.06 22096.82 21849.46 21997.29 22307.52 23530.41
[25] 24751.97 26950.76 28606.54 30683.55 32903.18 35269.82 37112.35 39704.71
[33] 42376.77 45362.04 47996.52 50947.81 52126.35 53299.96 54954.28 56123.22
[41] 57352.33 58168.97 60356.12 62896.86 65034.33 67221.53 69663.71 73778.17
```

(b)

```
df$total_other_services <- df$Dental+ df$Vision + df$"Other Professionals"
```

(D)

```
cihi <- data.frame(cihi, "Perscription.Drugs" = "Prescribed.Drugs")
```

(e) Using a single R command, determine the expenditure on hospitals in 1983.

```
Expenditure_1983 <- cihi["9", "Hospitals"]

#df$Hospitals[df$Year:1983]
```

(f) Using a singe R command, list the expenditures by year for 2012-202

```
df$Hospitals
```

```
 [1]  5136.77  5977.68  6372.73  6861.92  7487.62  8585.16 10127.35 12001.93
 [9] 13174.55 13936.30 14737.75 15937.05 17154.21 18497.17 20268.98 20528.15
[17] 21783.23 22652.40 22619.06 22096.82 21849.46 21997.29 22307.52 23530.41
[25] 24751.97 26950.76 28606.54 30683.55 32903.18 35269.82 37112.35 39704.71
[33] 42376.77 45362.04 47996.52 50947.81 52126.35 53299.96 54954.28 56123.22
[41] 57352.33 58168.97 60356.12 62896.86 65034.33 67221.53 69663.71 73778.17
```

```
Expenditure_2012_2022 <- cihi["38-48", "Hospitals"]
```

#3.3

(a)

```
mpg <- ggplot2::mpg
subset(mpg, year == 2008)
```

	manufacturer	model	displ	year	cyl	trans	drv	cty	hwy
3	audi	a4	2.0	2008	4	manual(m6)	f	20	31
4	audi	a4	2.0	2008	4	auto(av)	f	21	30
7	audi	a4	3.1	2008	6	auto(av)	f	18	27
10	audi	a4 quattro	2.0	2008	4	manual(m6)	4	20	28
11	audi	a4 quattro	2.0	2008	4	auto(s6)	4	19	27
14	audi	a4 quattro	3.1	2008	6	auto(s6)	4	17	25
15	audi	a4 quattro	3.1	2008	6	manual(m6)	4	15	25
17	audi	a6 quattro	3.1	2008	6	auto(s6)	4	17	25
18	audi	a6 quattro	4.2	2008	8	auto(s6)	4	16	23
19	chevrolet	c1500 suburban 2wd	5.3	2008	8	auto(l4)	r	14	20
20	chevrolet	c1500 suburban 2wd	5.3	2008	8	auto(l4)	r	11	15
21	chevrolet	c1500 suburban 2wd	5.3	2008	8	auto(l4)	r	14	20
23	chevrolet	c1500 suburban 2wd	6.0	2008	8	auto(l4)	r	12	17
26	chevrolet	corvette	6.2	2008	8	manual(m6)	r	16	26
27	chevrolet	corvette	6.2	2008	8	auto(s6)	r	15	25
28	chevrolet	corvette	7.0	2008	8	manual(m6)	r	15	24
29	chevrolet	k1500 tahoe 4wd	5.3	2008	8	auto(l4)	4	14	19
30	chevrolet	k1500 tahoe 4wd	5.3	2008	8	auto(l4)	4	11	14
34	chevrolet	malibu	2.4	2008	4	auto(l4)	f	22	30
36	chevrolet	malibu	3.5	2008	6	auto(l4)	f	18	29
37	chevrolet	malibu	3.6	2008	6	auto(s6)	f	17	26
42	dodge	caravan 2wd	3.3	2008	6	auto(l4)	f	17	24

43	dodge	caravan 2wd	3.3	2008	6	auto(l4)	f	17	24
44	dodge	caravan 2wd	3.3	2008	6	auto(l4)	f	11	17
47	dodge	caravan 2wd	3.8	2008	6	auto(l6)	f	16	23
48	dodge	caravan 2wd	4.0	2008	6	auto(l6)	f	16	23
49	dodge	dakota pickup 4wd	3.7	2008	6	manual(m6)	4	15	19
50	dodge	dakota pickup 4wd	3.7	2008	6	auto(l4)	4	14	18
53	dodge	dakota pickup 4wd	4.7	2008	8	auto(l5)	4	14	19
54	dodge	dakota pickup 4wd	4.7	2008	8	auto(l5)	4	14	19
55	dodge	dakota pickup 4wd	4.7	2008	8	auto(l5)	4	9	12
59	dodge	durango 4wd	4.7	2008	8	auto(l5)	4	13	17
60	dodge	durango 4wd	4.7	2008	8	auto(l5)	4	9	12
61	dodge	durango 4wd	4.7	2008	8	auto(l5)	4	13	17
63	dodge	durango 4wd	5.7	2008	8	auto(l5)	4	13	18
65	dodge	ram 1500 pickup 4wd	4.7	2008	8	manual(m6)	4	12	16
66	dodge	ram 1500 pickup 4wd	4.7	2008	8	auto(l5)	4	9	12
67	dodge	ram 1500 pickup 4wd	4.7	2008	8	auto(l5)	4	13	17
68	dodge	ram 1500 pickup 4wd	4.7	2008	8	auto(l5)	4	13	17
69	dodge	ram 1500 pickup 4wd	4.7	2008	8	manual(m6)	4	12	16
70	dodge	ram 1500 pickup 4wd	4.7	2008	8	manual(m6)	4	9	12
73	dodge	ram 1500 pickup 4wd	5.7	2008	8	auto(l5)	4	13	17
77	ford	expedition 2wd	5.4	2008	8	auto(l6)	r	12	18
81	ford	explorer 4wd	4.0	2008	6	auto(l5)	4	13	19
82	ford	explorer 4wd	4.6	2008	8	auto(l6)	4	13	19
88	ford	f150 pickup 4wd	4.6	2008	8	auto(l4)	4	13	17
90	ford	f150 pickup 4wd	5.4	2008	8	auto(l4)	4	13	17
93	ford	mustang	4.0	2008	6	manual(m5)	r	17	26
94	ford	mustang	4.0	2008	6	auto(l5)	r	16	24
97	ford	mustang	4.6	2008	8	manual(m5)	r	15	23
98	ford	mustang	4.6	2008	8	auto(l5)	r	15	22
99	ford	mustang	5.4	2008	8	manual(m6)	r	14	20
105	honda	civic	1.8	2008	4	manual(m5)	f	26	34
106	honda	civic	1.8	2008	4	auto(l5)	f	25	36
107	honda	civic	1.8	2008	4	auto(l5)	f	24	36
108	honda	civic	2.0	2008	4	manual(m6)	f	21	29
111	hyundai	sonata	2.4	2008	4	auto(l4)	f	21	30
112	hyundai	sonata	2.4	2008	4	manual(m5)	f	21	31
115	hyundai	sonata	3.3	2008	6	auto(l5)	f	19	28
118	hyundai	tiburon	2.0	2008	4	manual(m5)	f	20	28
119	hyundai	tiburon	2.0	2008	4	auto(l4)	f	20	27
120	hyundai	tiburon	2.7	2008	6	auto(l4)	f	17	24
121	hyundai	tiburon	2.7	2008	6	manual(m6)	f	16	24
122	hyundai	tiburon	2.7	2008	6	manual(m5)	f	17	24
123	jeep	grand cherokee 4wd	3.0	2008	6	auto(l5)	4	17	22

124	jeep	grand cherokee 4wd	3.7	2008	6	auto(l5)	4	15	19
127	jeep	grand cherokee 4wd	4.7	2008	8	auto(l5)	4	9	12
128	jeep	grand cherokee 4wd	4.7	2008	8	auto(l5)	4	14	19
129	jeep	grand cherokee 4wd	5.7	2008	8	auto(l5)	4	13	18
130	jeep	grand cherokee 4wd	6.1	2008	8	auto(l5)	4	11	14
132	land rover	range rover	4.2	2008	8	auto(s6)	4	12	18
133	land rover	range rover	4.4	2008	8	auto(s6)	4	12	18
137	lincoln	navigator 2wd	5.4	2008	8	auto(l6)	r	12	18
139	mercury	mountaineer 4wd	4.0	2008	6	auto(l5)	4	13	19
140	mercury	mountaineer 4wd	4.6	2008	8	auto(l6)	4	13	19
144	nissan	altima	2.5	2008	4	auto(av)	f	23	31
145	nissan	altima	2.5	2008	4	manual(m6)	f	23	32
146	nissan	altima	3.5	2008	6	manual(m6)	f	19	27
147	nissan	altima	3.5	2008	6	auto(av)	f	19	26
150	nissan	maxima	3.5	2008	6	auto(av)	f	19	25
153	nissan	pathfinder 4wd	4.0	2008	6	auto(l5)	4	14	20
154	nissan	pathfinder 4wd	5.6	2008	8	auto(s5)	4	12	18
158	pontiac	grand prix	3.8	2008	6	auto(l4)	f	18	28
159	pontiac	grand prix	5.3	2008	8	auto(s4)	f	16	25
162	subaru	forester awd	2.5	2008	4	manual(m5)	4	20	27
163	subaru	forester awd	2.5	2008	4	manual(m5)	4	19	25
164	subaru	forester awd	2.5	2008	4	auto(l4)	4	20	26
165	subaru	forester awd	2.5	2008	4	auto(l4)	4	18	23
170	subaru	impreza awd	2.5	2008	4	auto(s4)	4	20	25
171	subaru	impreza awd	2.5	2008	4	auto(s4)	4	20	27
172	subaru	impreza awd	2.5	2008	4	manual(m5)	4	19	25
173	subaru	impreza awd	2.5	2008	4	manual(m5)	4	20	27
178	toyota	4runner 4wd	4.0	2008	6	auto(l5)	4	16	20
179	toyota	4runner 4wd	4.7	2008	8	auto(l5)	4	14	17
182	toyota	camry	2.4	2008	4	manual(m5)	f	21	31
183	toyota	camry	2.4	2008	4	auto(l5)	f	21	31
186	toyota	camry	3.5	2008	6	auto(s6)	f	19	28
189	toyota	camry solara	2.4	2008	4	manual(m5)	f	21	31
190	toyota	camry solara	2.4	2008	4	auto(s5)	f	22	31
193	toyota	camry solara	3.3	2008	6	auto(s5)	f	18	27
197	toyota	corolla	1.8	2008	4	manual(m5)	f	28	37
198	toyota	corolla	1.8	2008	4	auto(l4)	f	26	35
200	toyota	land cruiser wagon 4wd	5.7	2008	8	auto(s6)	4	13	18
203	toyota	toyota tacoma 4wd	2.7	2008	4	manual(m5)	4	17	22
206	toyota	toyota tacoma 4wd	4.0	2008	6	manual(m6)	4	15	18
207	toyota	toyota tacoma 4wd	4.0	2008	6	auto(l5)	4	16	20
210	volkswagen	gti	2.0	2008	4	manual(m6)	f	21	29
211	volkswagen	gti	2.0	2008	4	auto(s6)	f	22	29

```
216   volkswagen            jetta   2.0 2008   4   auto(s6)   f  22  29
217   volkswagen            jetta   2.0 2008   4 manual(m6)   f  21  29
218   volkswagen            jetta   2.5 2008   5   auto(s6)   f  21  29
219   volkswagen            jetta   2.5 2008   5 manual(m5)   f  21  29
226   volkswagen       new beetle   2.5 2008   5 manual(m5)   f  20  28
227   volkswagen       new beetle   2.5 2008   5   auto(s6)   f  20  29
230   volkswagen           passat   2.0 2008   4   auto(s6)   f  19  28
231   volkswagen           passat   2.0 2008   4 manual(m6)   f  21  29
234   volkswagen           passat   3.6 2008   6   auto(s6)   f  17  26
    fl      class
3    p    compact
4    p    compact
7    p    compact
10   p    compact
11   p    compact
14   p    compact
15   p    compact
17   p    midsize
18   p    midsize
19   r        suv
20   e        suv
21   r        suv
23   r        suv
26   p    2seater
27   p    2seater
28   p    2seater
29   r        suv
30   e        suv
34   r    midsize
36   r    midsize
37   r    midsize
42   r    minivan
43   r    minivan
44   e    minivan
47   r    minivan
48   r    minivan
49   r     pickup
50   r     pickup
53   r     pickup
54   r     pickup
55   e     pickup
59   r        suv
60   e        suv
```

```
61   r        suv
63   r        suv
65   r     pickup
66   e     pickup
67   r     pickup
68   r     pickup
69   r     pickup
70   e     pickup
73   r     pickup
77   r        suv
81   r        suv
82   r        suv
88   r     pickup
90   r     pickup
93   r subcompact
94   r subcompact
97   r subcompact
98   r subcompact
99   p subcompact
105  r subcompact
106  r subcompact
107  c subcompact
108  p subcompact
111  r    midsize
112  r    midsize
115  r    midsize
118  r subcompact
119  r subcompact
120  r subcompact
121  r subcompact
122  r subcompact
123  d        suv
124  r        suv
127  e        suv
128  r        suv
129  r        suv
130  p        suv
132  r        suv
133  r        suv
137  r        suv
139  r        suv
140  r        suv
144  r    midsize
```

```
145  r    midsize
146  p    midsize
147  p    midsize
150  p    midsize
153  p        suv
154  p        suv
158  r    midsize
159  p    midsize
162  r        suv
163  p        suv
164  r        suv
165  p        suv
170  p    compact
171  r    compact
172  p    compact
173  r    compact
178  r        suv
179  r        suv
182  r    midsize
183  r    midsize
186  r    midsize
189  r    compact
190  r    compact
193  r    compact
197  r    compact
198  r    compact
200  r        suv
203  r     pickup
206  r     pickup
207  r     pickup
210  p    compact
211  p    compact
216  p    compact
217  p    compact
218  r    compact
219  r    compact
226  r subcompact
227  r subcompact
230  p    midsize
231  p    midsize
234  p    midsize
```

```r
min(mpg$cty)
```

```
[1] 9
```

```r
max(mpg$cty)
```

```
[1] 35
```

(b)

```r
n <- 11
avg_mpg = sum(mpg$cty)/n
```

$$AvgMpg = \frac{sum_{i-1}^{n} cty_i}{n}$$

(c)

```r
mean(mpg$cty)
```

```
[1] 16.85897
```

(d)

```r
compact <- subset(mpg, class == "compact")
 ifelse(compact == "compact", 1, 0)
```

```
    manufacturer model displ year cyl trans drv cty hwy fl class
1              0     0     0    0   0     0   0   0   0  0     1
2              0     0     0    0   0     0   0   0   0  0     1
3              0     0     0    0   0     0   0   0   0  0     1
4              0     0     0    0   0     0   0   0   0  0     1
5              0     0     0    0   0     0   0   0   0  0     1
6              0     0     0    0   0     0   0   0   0  0     1
7              0     0     0    0   0     0   0   0   0  0     1
8              0     0     0    0   0     0   0   0   0  0     1
9              0     0     0    0   0     0   0   0   0  0     1
10             0     0     0    0   0     0   0   0   0  0     1
11             0     0     0    0   0     0   0   0   0  0     1
```

12	0	0	0	0	0	0	0	0	0	0	1
13	0	0	0	0	0	0	0	0	0	0	1
14	0	0	0	0	0	0	0	0	0	0	1
15	0	0	0	0	0	0	0	0	0	0	1
142	0	0	0	0	0	0	0	0	0	0	1
143	0	0	0	0	0	0	0	0	0	0	1
170	0	0	0	0	0	0	0	0	0	0	1
171	0	0	0	0	0	0	0	0	0	0	1
172	0	0	0	0	0	0	0	0	0	0	1
173	0	0	0	0	0	0	0	0	0	0	1
187	0	0	0	0	0	0	0	0	0	0	1
188	0	0	0	0	0	0	0	0	0	0	1
189	0	0	0	0	0	0	0	0	0	0	1
190	0	0	0	0	0	0	0	0	0	0	1
191	0	0	0	0	0	0	0	0	0	0	1
192	0	0	0	0	0	0	0	0	0	0	1
193	0	0	0	0	0	0	0	0	0	0	1
194	0	0	0	0	0	0	0	0	0	0	1
195	0	0	0	0	0	0	0	0	0	0	1
196	0	0	0	0	0	0	0	0	0	0	1
197	0	0	0	0	0	0	0	0	0	0	1
198	0	0	0	0	0	0	0	0	0	0	1
208	0	0	0	0	0	0	0	0	0	0	1
209	0	0	0	0	0	0	0	0	0	0	1
210	0	0	0	0	0	0	0	0	0	0	1
211	0	0	0	0	0	0	0	0	0	0	1
212	0	0	0	0	0	0	0	0	0	0	1
213	0	0	0	0	0	0	0	0	0	0	1
214	0	0	0	0	0	0	0	0	0	0	1
215	0	0	0	0	0	0	0	0	0	0	1
216	0	0	0	0	0	0	0	0	0	0	1
217	0	0	0	0	0	0	0	0	0	0	1
218	0	0	0	0	0	0	0	0	0	0	1
219	0	0	0	0	0	0	0	0	0	0	1
220	0	0	0	0	0	0	0	0	0	0	1
221	0	0	0	0	0	0	0	0	0	0	1

```
 #x <- c(-2, 0, 3)
 #ifelse(x > 0, "Positive", "Not Positive")
#compact <- subset(mpg, class == "compact")
```

(e) Estimate average miles per gallon within cit limits for compact cars

```r
avg_mpg <- mean(compact$cty)
```

(f) Create a Scatter Plot X-axis city mpg (cty) Y-axis highway mpg(hwy)

```r
x <- mpg$cty
y <- mpg$hwy

plot(x, y, main="Figure 1 shows that fuel efficient for the city driving versus high driving
```