---problem 2---

 # (a)

```
x <- runif(10000, min=-2, max=2)
y <- runif(10000,x,2)
plot(density(y), main="marginal univariate density of y")
```

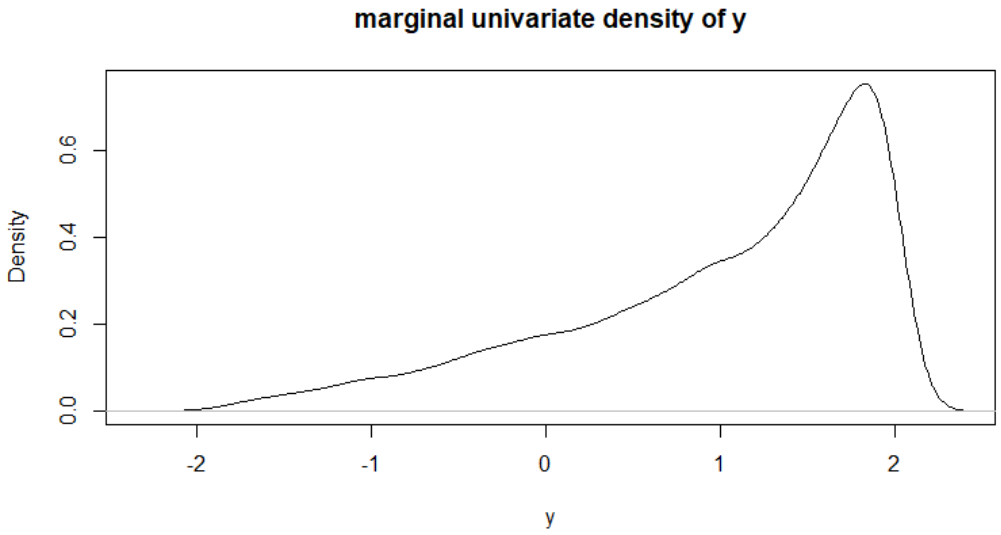

Figure 1

```
library("MASS")
persp(kde2d(x, y),theta = 15, ticktype = "detailed",
      xlab = "X", ylab = "Y", main="bivariate density of (X,Y)")
```

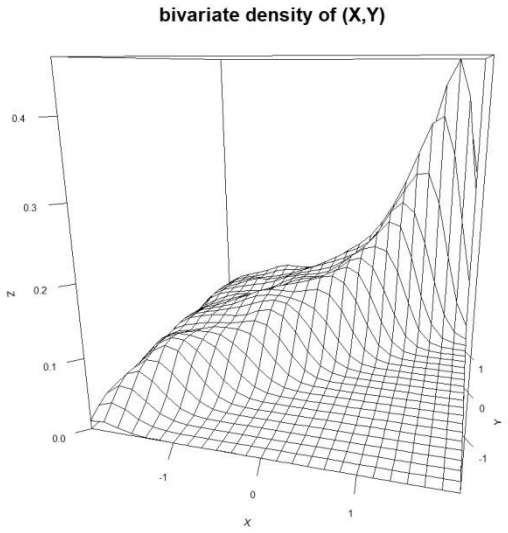

Figure 2

 # (b)

```
mean(y)
```

---problem 4---

calculate std through 1584 funds

```
tbl_funds <- read.csv('funds-1584g-mon.csv')
std <- sapply(tbl_funds[,2:ncol(tbl_funds)], sd)
avg_std <- mean(std)
```

simulate normal random variables

```
tbl_tstat <- matrix(0,nrow=1,ncol=100)
tbl_high_tstat <- matrix(0,nrow=10000,ncol=5)
tbl_rand_tstat <- matrix(0,nrow=10000,ncol=5)

for (j in 1:10000){
   tbl_norm <- rnorm(6000,0.01,avg_std)
   dim(tbl_norm) <- c(60,100)
   for (i in 1:100) {
      tbl_tstat[i] <- abs(t.test(tbl_norm[,i], mu=0.01, conf.level = 0.95)$statistic)
   }
   high_tstat <- sort(tbl_tstat,decreasing = TRUE)[1:5]
   rand_tstat <- sample(tbl_tstat)[1:5]
   tbl_high_tstat[j,] <- high_tstat
   tbl_rand_tstat[j,] <- rand_tstat
}
```

info required for Table1

```
round(colMeans(tbl_high_tstat),4)
round(colMeans(tbl_rand_tstat),4)

round(colSums(abs(tbl_high_tstat)>=2)/nrow(tbl_high_tstat),3)
round(colSums(abs(tbl_rand_tstat)>=2)/nrow(tbl_rand_tstat),3)

quantile_high <- matrix(0,nrow=1,ncol=5)
quantile_rand <- matrix(0,nrow=1,ncol=5)
for (i in 1:5) {quantile_high[i] <- round(quantile(tbl_high_tstat[,i], 0.975),4)}
for (i in 1:5) {quantile_rand[i] <- round(quantile(tbl_rand_tstat[,i], 0.975),4)}
```

Table 1: Simulated Type 1 error – probability of rejection under the H0

	Highest five (of 100) t-statistics				
	t_1	t_2	t_2	t_4	t_5
1) Mean	2.8583	2.4879	2.2879	2.1493	2.0426
2) Pr(reject H_0|H_0 true)	0.994	0.963	0.884	0.744	0.569
3) 97.5% of t_i	3.8904	3.1612	2.8296	2.6313	2.4711

	Randomly chosen five t-statistics				
	t1	t2	t2	t4	t5
1) Mean	0.0157	-0.0129	0.0021	0.0052	0.0050
2) Pr(reject H_0|H_0 true)	0.053	0.050	0.050	0.052	0.048
3) 97.5% of t_i	2.0233	1.9949	1.9972	2.0095	1.9813

 # plot figure3

```
hist(tbl_high_tstat[,5], nclass=100,
     xlab="the fifth highest t-statistic",
     main="histogram of the fifth highest t-statistic")
abline(v=2, col="black",lwd=3)
abline(v=quantile_high[5], col="black",lwd=3)
```

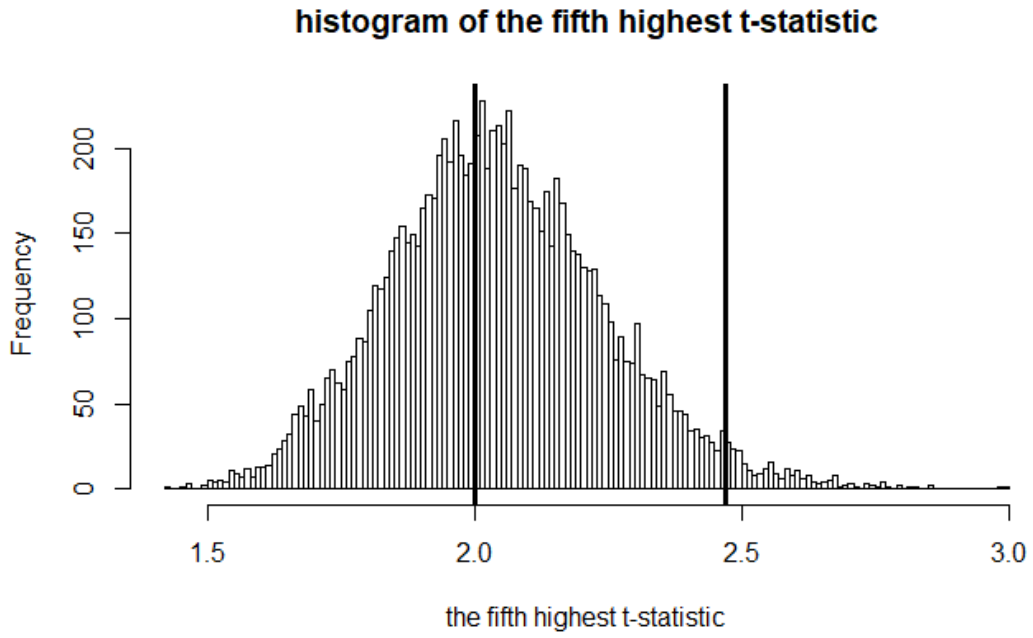

Figure 3