Project3

Huanyu Liu

1/30/2019

Problem 1

$$P(Y_2 > 5) = 0.974$$
$$E(X_2^{1/3}) = 0.658903$$
$$E(Y_3) = 25.8096$$
$$E(X_2 Y_2 1(X_2 > 1)) = 4.09305$$

Problem 2

$$E((1 + X_3)^{1/3}) = 1.32474$$
$$E((1 + Y_3)^{1/3}) = 1.33535$$

Problem 3

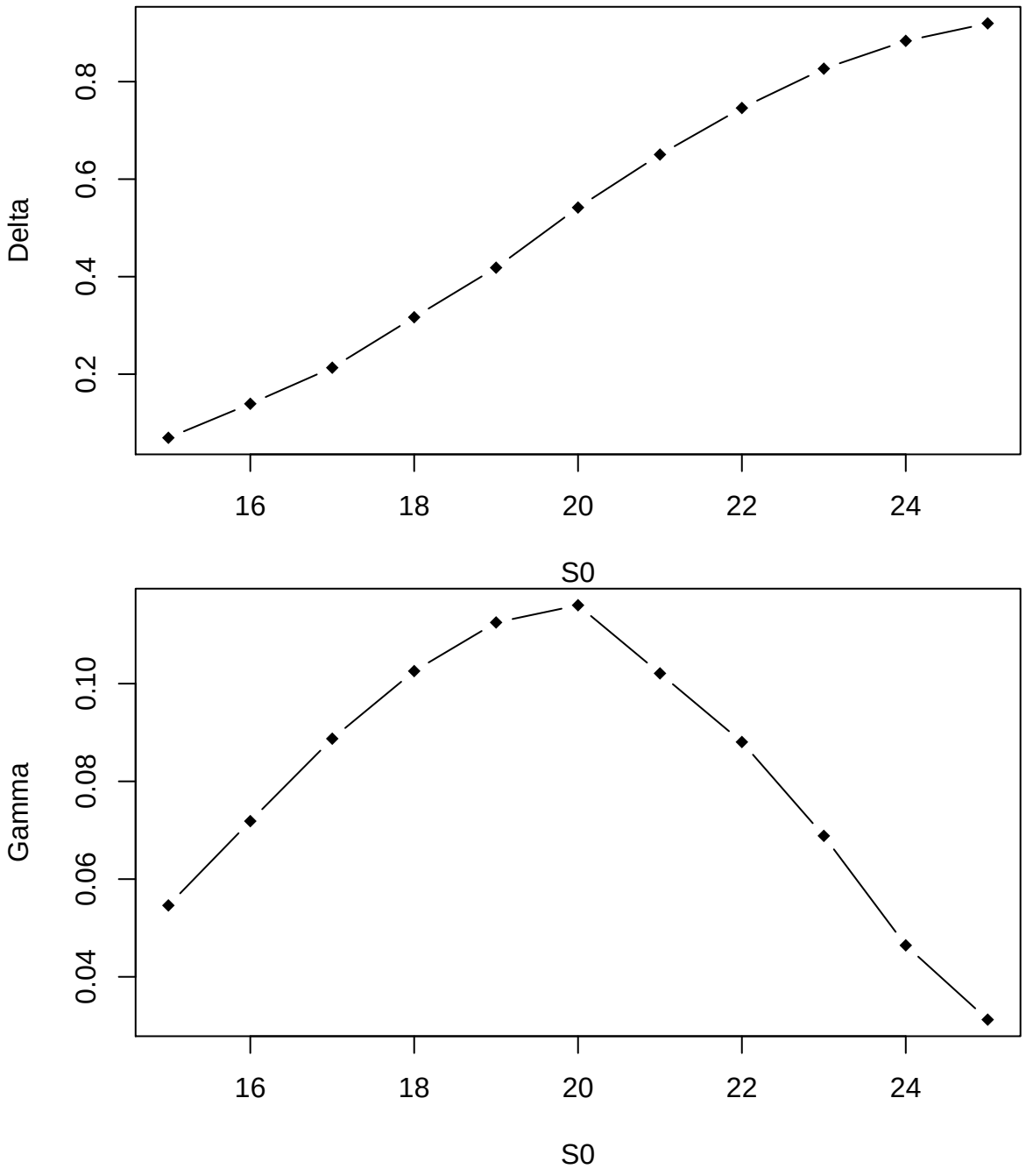
(a)

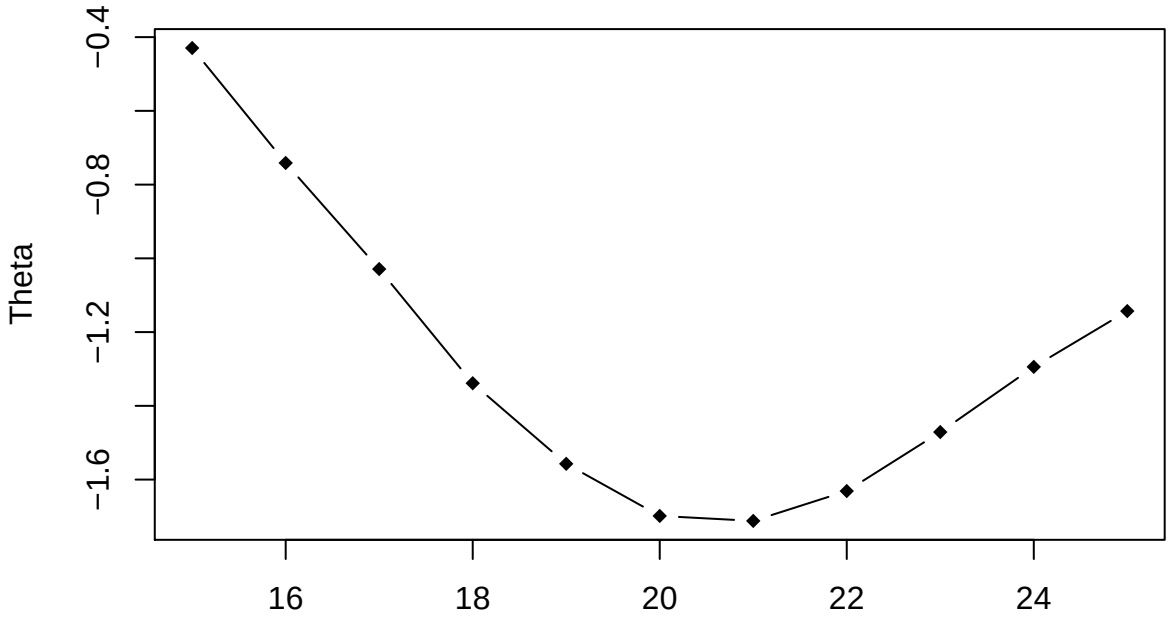
```
library("knitr")
df = read.csv("Project3_P3.csv")
kable(df,caption="Call Option stas")
```

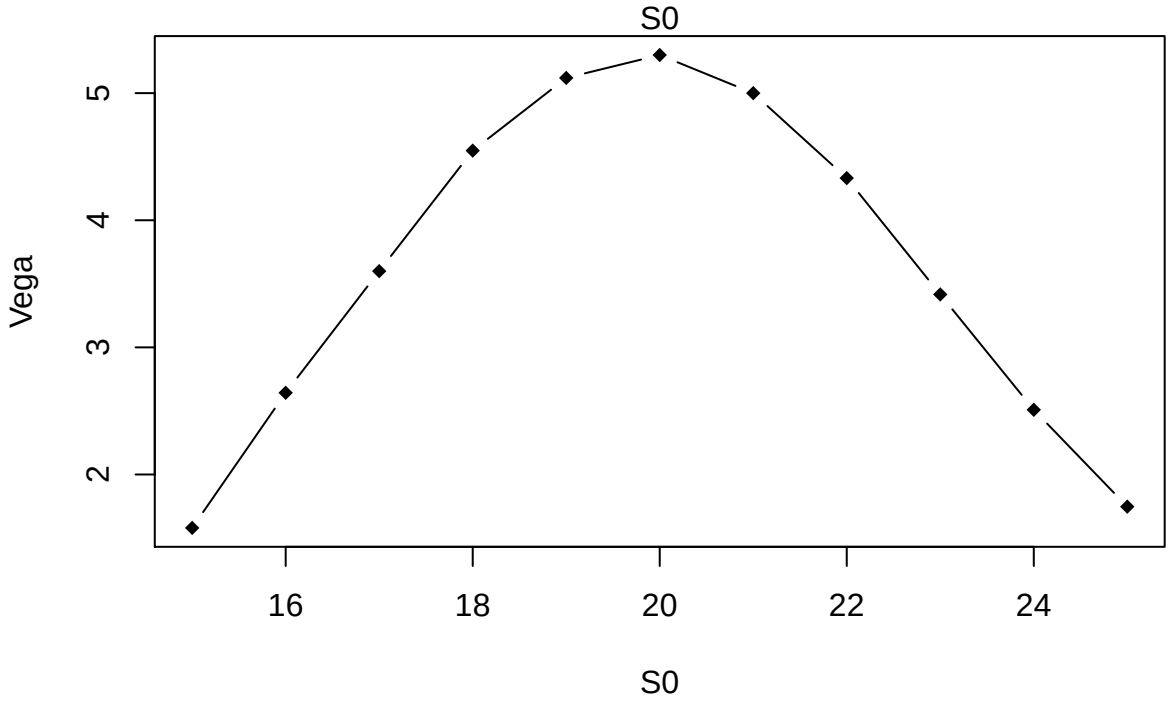
Table 1: Call Option stas

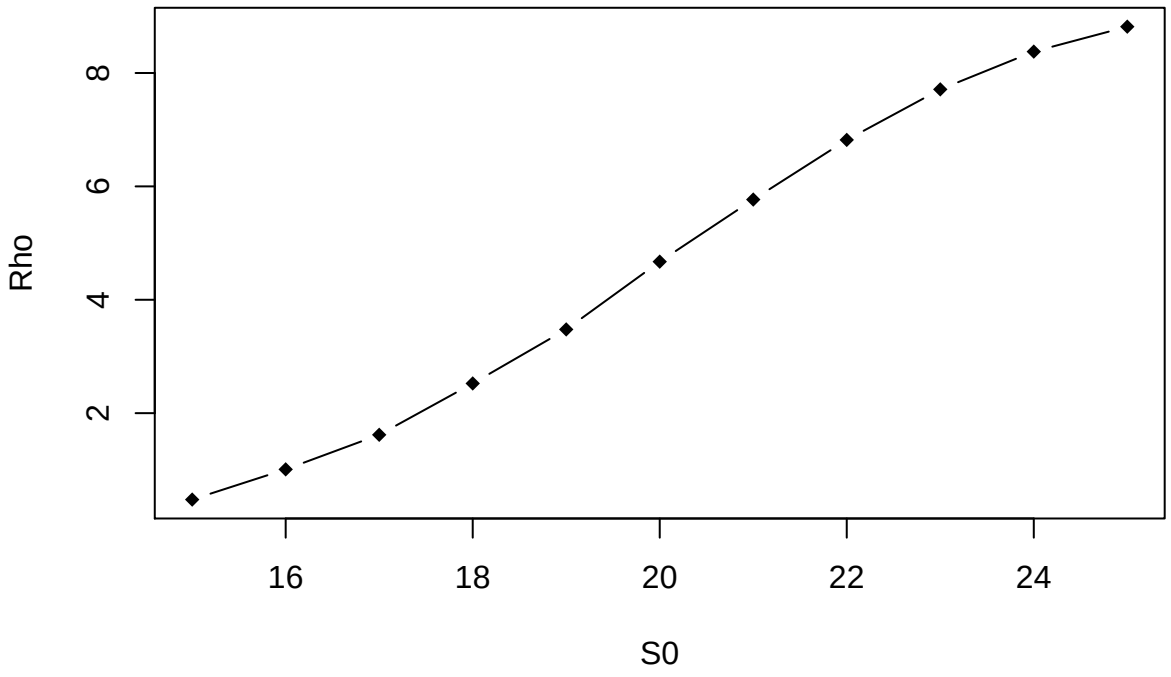
s0	Monte.Carlo.Call	Black.Scholes.Call	Delta	Gamma	Theta	Vega	Rho
15	0.103193	0.0857532	0.069530	0.0546167	-0.429554	1.57978	0.475535
16	0.208819	0.1942620	0.139252	0.0718603	-0.741295	2.64276	1.008290
17	0.385409	0.3828170	0.213251	0.0887314	-1.028970	3.59975	1.618020
18	0.651188	0.6732210	0.316715	0.1025680	-1.338680	4.54768	2.523940
19	1.016530	1.0786800	0.418386	0.1125170	-1.557270	5.11967	3.476700
20	1.499390	1.6016000	0.541748	0.1160390	-1.698530	5.29997	4.672250
21	2.091090	2.2345100	0.650464	0.1020950	-1.712060	4.99994	5.767690
22	2.793200	2.9630400	0.745938	0.0880513	-1.631090	4.33174	6.819590
23	3.582710	3.7695400	0.826567	0.0688495	-1.471130	3.41638	7.711020
24	4.439580	4.6361800	0.883637	0.0464463	-1.294340	2.50891	8.377340
25	5.342250	5.5470600	0.919460	0.0312438	-1.142980	1.74694	8.816860

```
greeks = c("Delta", "Gamma", "Theta", "Vega", "Rho")
for (i in c(1:5)){
  plot(x = df[[1]], y = df[[i+3]], xlab = "S0", ylab = greeks[i], type = "b", pch = 18)
}
```


Delta
0.2
0.4
0.6
0.8
16
18
20
22
24
S0
Gamma
0.04
0.06
0.08
0.10
16
18
20
22
24
S0


Theta
−0.4
−0.8
−1.2
−1.6
16
18
20
22
24
S0


Vega
5
4
3
2
16
18
20
22
24
S0



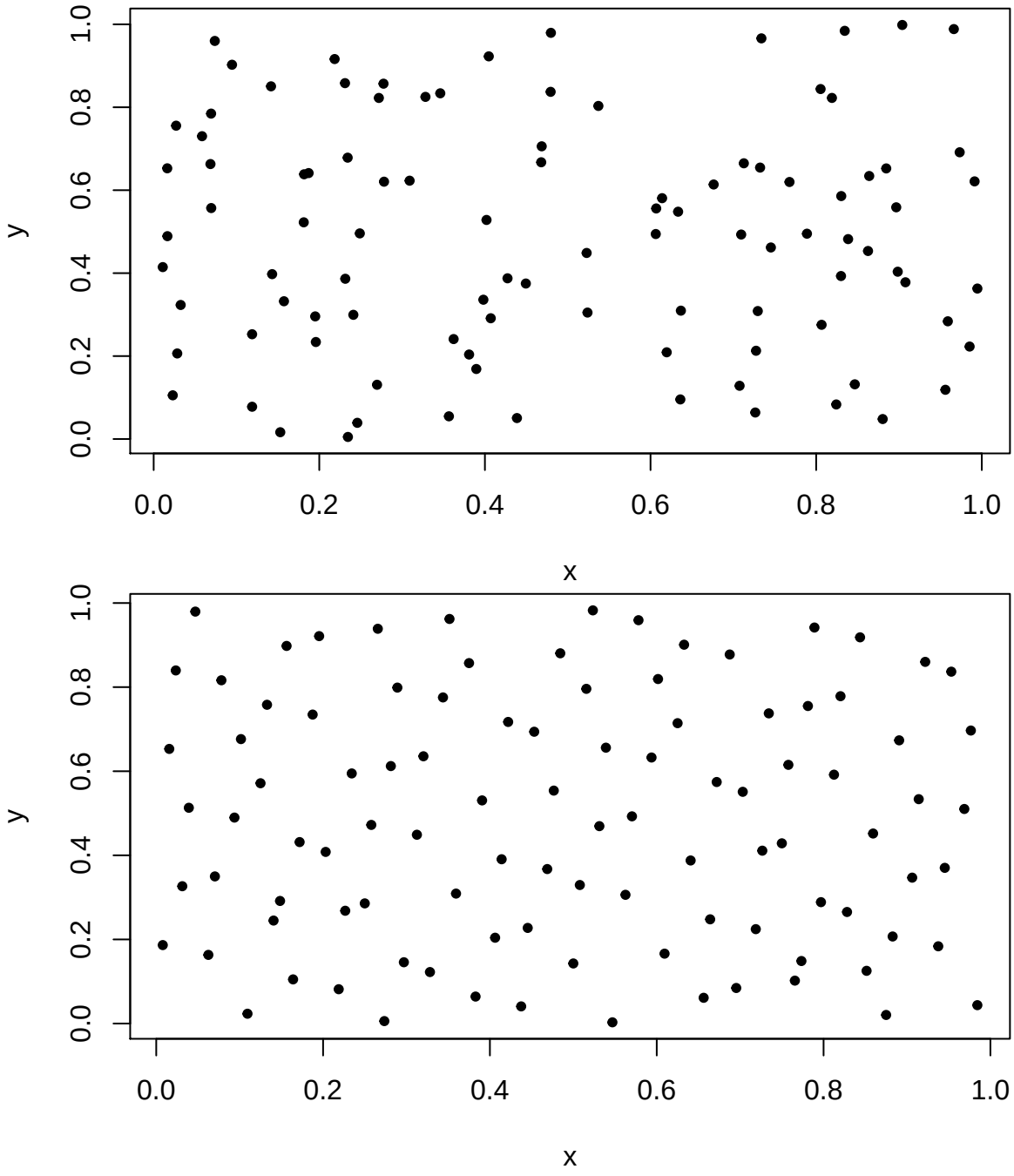
Problem 4

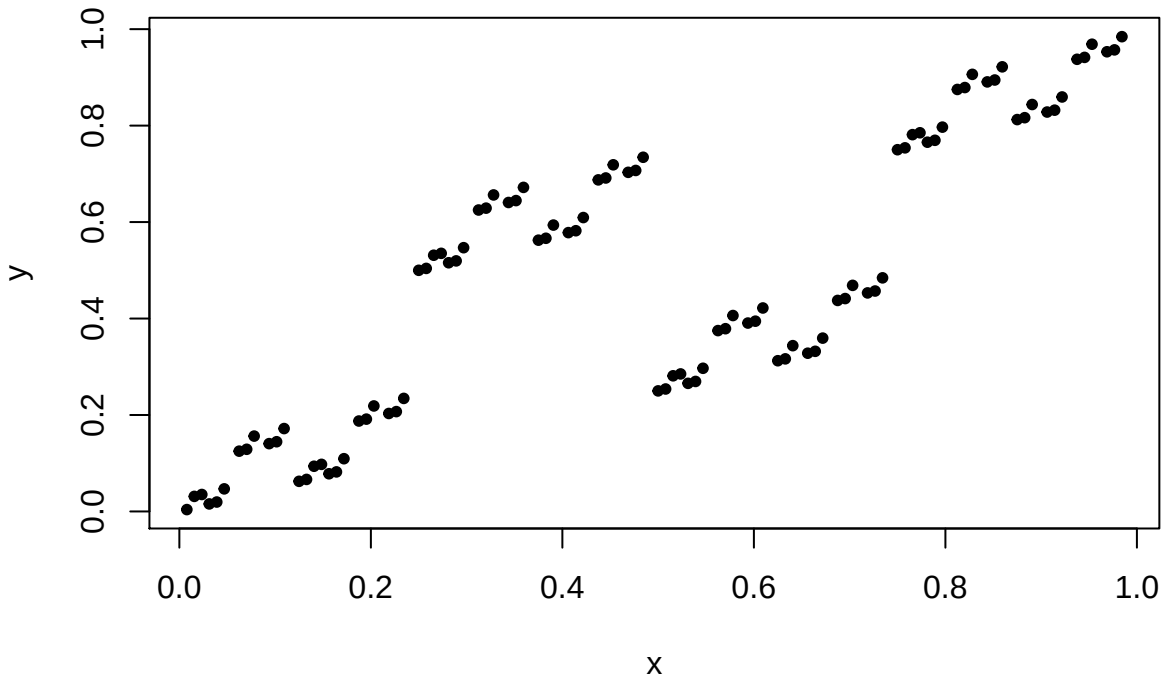
T = 0.5
K = 50
Full Truncation: C1 = 2.59491
Partial Truncation: C2 = 2.59491
Reflection Method: C3 = 2.59491

Problem 5

(d)

```
df2 = read.csv("Project3_P5.csv", header = FALSE)
for (i in c(1,3,5)){
  plot(x = df2[[i]], y = df2[[i+1]], xlab = "x", ylab = "y",pch = 20)
}
```


y
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.2
0.4
0.6
0.8
1.0
x
y
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.2
0.4
0.6
0.8
1.0
x



Both Uniform and 2-dimension Halton with base 2 and 7 can produce random sequence numbers, however, 2-dimension Halton with base 2 and 4 is not a sequence of random numbers. There is correlation of the sequences by Halton with base 2 and with base 4.

(e)

$$\int_0^1 \int_0^1 e^{-xy}(sin6\pi x + cos^{\frac{1}{3}} 2\pi y)dxdy$$

By (2,4), value = -0.0048839
By (2,7), value = 0.0261144
By (5,7), value = 0.0261637