CF_3

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Question 1. Expected Values and Probabilities

```
##         p1         e1         e2         e3
##  0.9782000  0.6323197 25.8535242  3.9329464
```

The expected values and probabilities with 10,000 paths and 0.01 step size is:

```
##         p1         e1         e2         e3
##  0.9782000  0.6323197 25.8535242  3.9329464
```

Question 2. Expected Values

The resulting expected values for e1 and e2 with 10,000 paths and 0.01 step size is:

```
##       e1       e2
## 1.339267 1.734339
```

Question 3 Monte Carlo Option Pricing

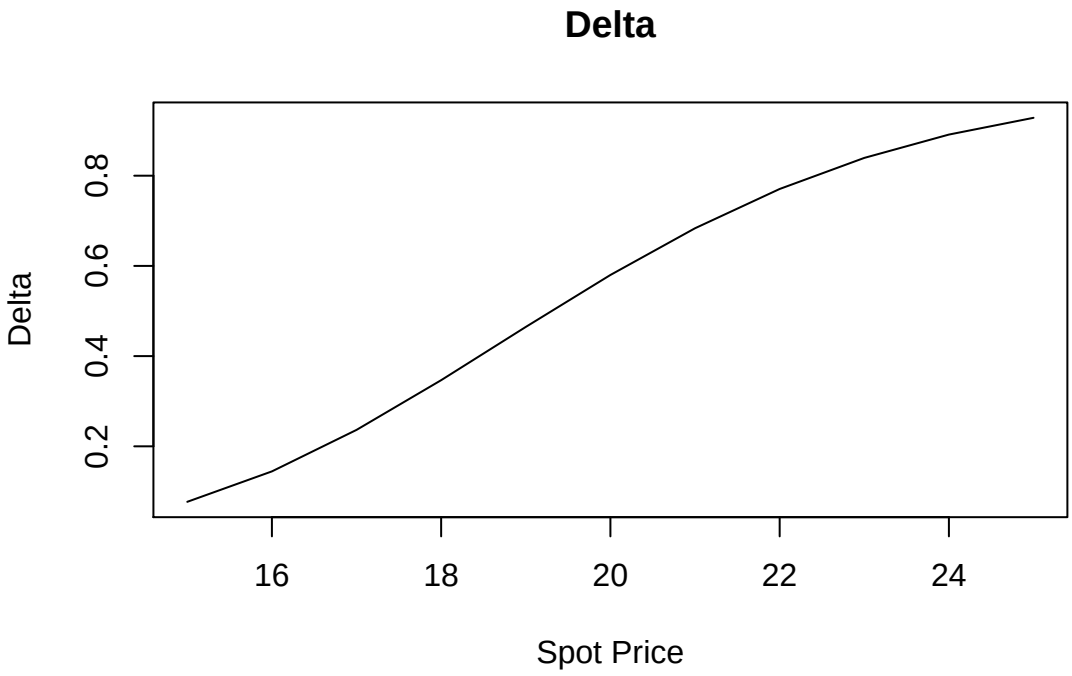
(a.) The European option price with parameters $S_0 = 20$, $X = 20$, $\sigma = 0.25$, $r = 0.04$, $T = 0.5$ and antithetic variate reduction technique with 10,000 paths is shown below:

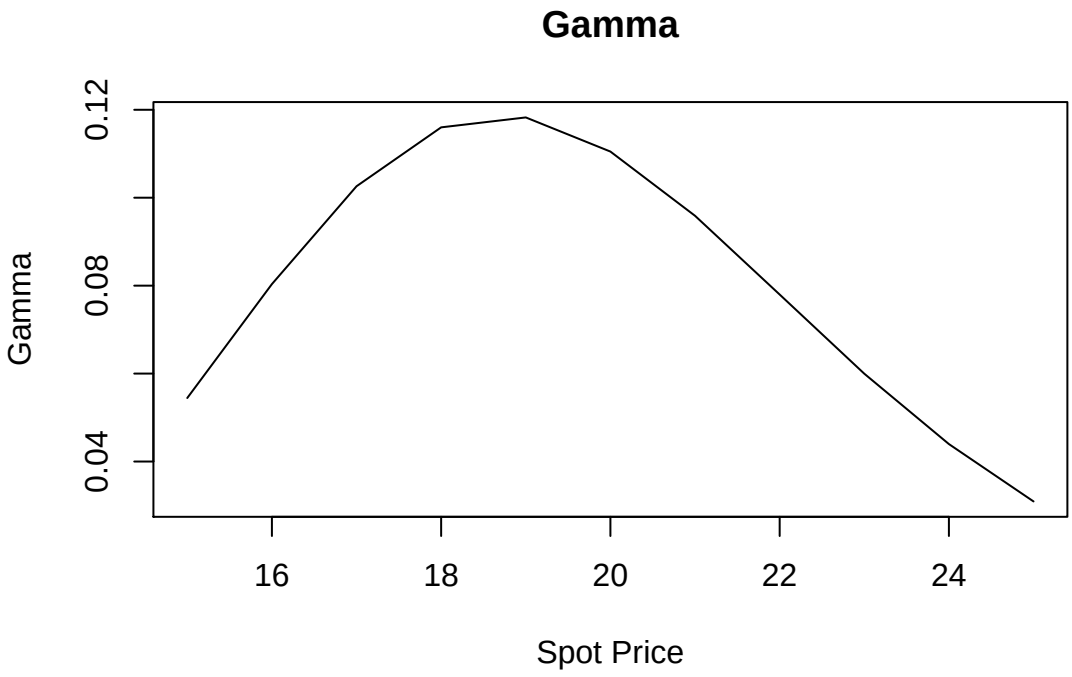
```
## [1] 1.577381
```

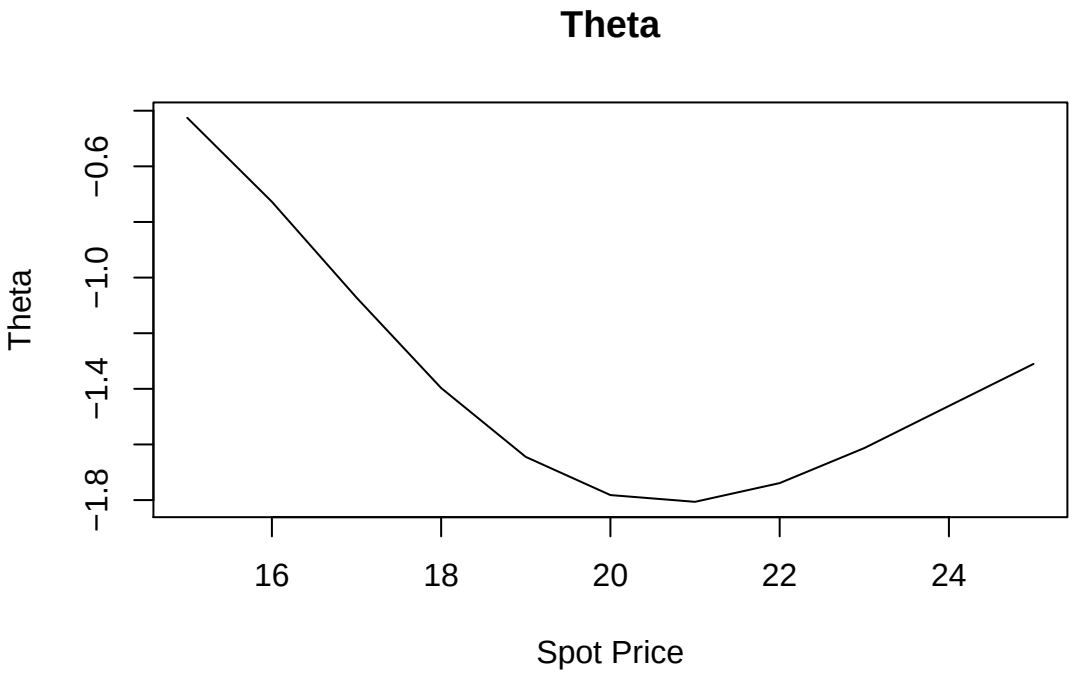
(b.) The price of the call option using the Black-Scholes formula and with the same parameters ($S_0 = 20$, $X = 20$, $\sigma = 0.25$, $r = 0.04$, $T = 0.5$) and the approimation of $N(.)$ is shown below:

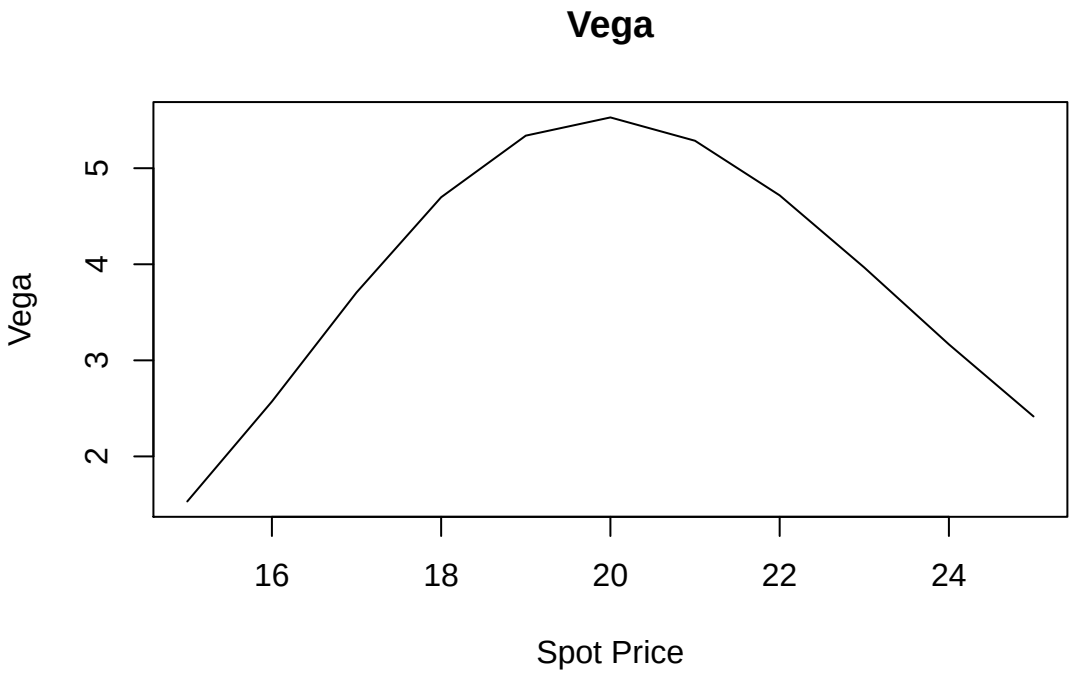
```
##    prc
## 1.6016
```

(c.) The plot for the greeks with stock prices 15:25 is shown by the figures below:


Delta
Delta
0.2
0.4
0.6
0.8
16
18
20
22
24
Spot Price


Gamma
Gamma
0.04
0.08
0.12
16
18
20
22
24
Spot Price





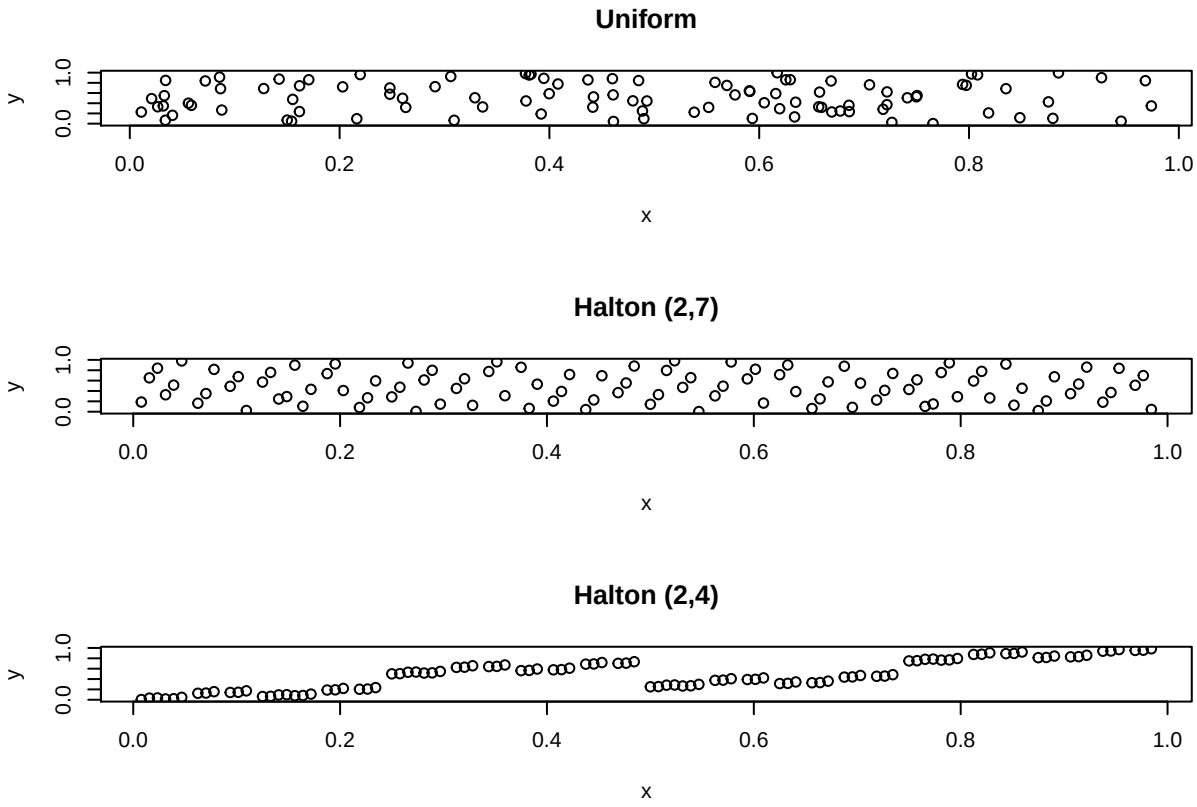
Question 4. Heston Model

The price of a European Call using the Heston Model wiith 100,000 paths and step size = 0.01 for the reflection (c1), partial truncation (c2) and full truncation (c3) method respectively is shown below:

```
##       c1       c2       c3
## 4.847764 4.828704 4.854289
```

Question 5. Quasi Monte-Carlo

(d.) The plots for all three 2-D generated sequences is shown below:



The Halton(2,7) with the prime number bases show the most uniformly distributed sequence which makes it the most ideal to use to approximate the value of integrals. The sequences generated from the uniform distribution are quite spread out nicely but the Haston sequence are still ahead in terms of evenly spread out points. The Halton (2,4), however, has the same common factor and thus suffers from it which results in a non-uniformly spread out points and instead forms a certain region where the sequences are most concentrated at.

(e.) Using the 2-D Halton and 10,000 number of sequences, the estimates of the integral for the different bases (2,7), (2,4), (5,7) are given by:

```
## $`2,7`
## [1] 0.0261144
##
## $`2,4`
## [1] -0.004883898
##
## $`5,7`
```

```
## [1] 0.02616366
```