STAT3013/3913 Computer Exercise week 10

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```
> x = rgamma(200, shape = 5, scale = 2)
> xb = mean(x)
> v = var(x)
> a.mom = (xb^2)/v
> b.mom = v/xb
> m = mean(log(x/xb))
> a0 = a.mom
> print(a0)
```

```
[1] 6.680434
```

```
> g = m + log(a0) - digamma(a0)
> gd = (1/a0) - trigamma(a0)
> a1 = a0 - g/gd
> print(a1)
```

```
[1] 6.426513
```

```
> a = a1
> for (i in 1:9) {
+     g = m + log(a) - digamma(a)
+     gd = (1/a) - trigamma(a)
+     a = a - g/gd
+     print(a)
+ }
```

```
[1] 6.436006
[1] 6.43602
[1] 6.43602
[1] 6.43602
[1] 6.43602
[1] 6.43602
[1] 6.43602
[1] 6.43602
[1] 6.43602
```

```
> a.mle = a
> b.mle = xb/a.mle
> b1 = xb/a1
> c(a.mle, b.mle)

[1] 6.436020 1.598355

> c(a1, b1)

[1] 6.426513 1.600719

> c(a.mom, b.mom)

[1] 6.680434 1.539876

> M = matrix(rgamma(2e+05, shape = 5, scale = 2), 1000, 200)
> A.mom <- B.mom <- A1 <- B1 <- A.mle <- B.mle <- 0
> for (j in 1:1000) {
+     x = M[j, ]
+     xb = mean(x)
+     v = var(x)
+     A.mom[j] = (xb^2)/v
+     B.mom[j] = v/xb
+     m = mean(log(x/xb))
+     a0 = A.mom[j]
+     g = m + log(a0) - digamma(a0)
+     gd = (1/a0) - trigamma(a0)
+     a1 = a0 - g/gd
+     A1[j] = a1
+     B1[j] = xb/a1
+     a = a1
+     for (i in 1:9) {
+         g = m + log(a) - digamma(a)
+         gd = (1/a) - trigamma(a)
+         a = a - g/gd
+     }
+     A.mle[j] = a
+     B.mle[j] = xb/a
+ }

> mean((A.mom - 5)^2)

[1] 0.2898101

> mean((A1 - 5)^2)
```

```
[1] 0.2235590

> mean((A.mle - 5)^2)

[1] 0.2247721

> mean((B.mom - 2)^2)

[1] 0.04914646

> mean((B1 - 2)^2)

[1] 0.03890181

> mean((B.mle - 2)^2)

[1] 0.03845759
```

It would seem that the method-of-moments are the worst, while the one-step and mle's have very similar performance.