LAB 08

- Question **1**

Following values were obtained in one of the sample run of the program to estimate I :

$$\mathbf{I = E(\exp(\sqrt{U}))}$$

```
The 95% confidence interval for M =  100  is ( 1.99991 , 2.000316 )
The estimated mean of I is  2.02655

The 95% confidence interval for M =  1000  is ( 1.99991 , 2.000316 )
The estimated mean of I is  1.994623

The 95% confidence interval for M =  10000  is ( 1.99991 , 2.000316 )
The estimated mean of I is  1.99753

The 95% confidence interval for M =  1e+05  is ( 1.99991 , 2.000316 )
The estimated mean of I is  2.001461
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◆ Question 2

Anthithetic Variable were used in the following way to increase the efficiency of estimator by decreasing variance :

$$\mathbf{Y = (exp(\sqrt{}\ U_i) + exp(\sqrt{}\ 1 - U_i)\ ) / 2}$$

Following values were obtained in one of the sample run of the program to estimate $\mathbf{I = E(exp(\sqrt{}\ U))}$:

```
95% confidence interval for M =  100  is ( 1.99991 , 2.000316 ).
Var(Y1) =  0.1836068  Var(Y) =  0.001070836
Variation reduction percentage from variance of (Y1)/2 is :  98.83356
Variation reduction percentage from variance of Y1 is :  99.41678

95% confidence interval for M =  1000  is ( 1.99991 , 2.000316 ).
Var(Y1) =  0.199652  Var(Y) =  0.001090033
Variation reduction percentage from variance of (Y1)/2 is :  98.90807
Variation reduction percentage from variance of Y1 is :  99.45403

95% confidence interval for M =  10000  is ( 1.99991 , 2.000316 ).
Var(Y1) =  0.1947  Var(Y) =  0.001073072
Variation reduction percentage from variance of (Y1)/2 is :  98.89772
Variation reduction percentage from variance of Y1 is :  99.44886

95% confidence interval for M =  1e+05  is ( 1.99991 , 2.000316 ).
Var(Y1) =  0.1953412  Var(Y) =  0.001088484
Variation reduction percentage from variance of (Y1)/2 is :  98.88556
Variation reduction percentage from variance of Y1 is :  99.44278
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◆ Question 3

Sqrt(U) is used as a control variable and efficiency of estimator used to estimate **I = E(exp(√ U))** was improved by reducing the variance.

Following values were obtained in one of the sample run of the program to estimate
I = E(exp(√ U)) :

```
The 95% confidence interval for M =  100  is ( 2.000831 , 2.001474 )
Original Variance =  0.193989  Reduced Variance =  0.002698865
Variance Reduction Percentage =  98.60875

The 95% confidence interval for M =  1000  is ( 2.000831 , 2.001474 )
Original Variance =  0.193989  Reduced Variance =  0.002698865
Variance Reduction Percentage =  98.60875

The 95% confidence interval for M =  10000  is ( 2.000831 , 2.001474 )
Original Variance =  0.193989  Reduced Variance =  0.002698865
Variance Reduction Percentage =  98.60875

The 95% confidence interval for M =  1e+05  is ( 2.000831 , 2.001474 )
Original Variance =  0.193989  Reduced Variance =  0.002698865
Variance Reduction Percentage =  98.60875
```