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title: "Monte Carlo Simulation for Option Pricing"
author: "Muthahar Nasim"
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output: pdf_document
```

Problem : Monte Carlo Simulations for Options Pricing: A difference equation for the future price S of a stock at time t, as a random variable, is given by the discrete version of the famous Black-Scholes equation, which specifies the dynamics of the stock price increment: $\Delta S = rS\Delta t + \sigma S\Delta W$ where r is the annual risk-free interest rate, σ is called the volatility parameter, Δt is a small time period given in years, and $\Delta W \sim N(0, \Delta t)$ is Normally distributed r.v. with mean 0 and variance Δt. Alternatively $\Delta W = \sqrt{\Delta t}N$, where $N \sim N(0, 1)$ is standard Normal. Take r = 0.03 per year, σ = 0.4 per square root year, 1-day increment Δt = 1 252 years (we take 252 trading days in a year), and a starting stock price of S(0) = 100. Simulate this special random walk to find the sampling distribution of the terminal stock price S(T) in T = 0.5 years, by creating a histogram of the vector of end stock prices for n = 10, 000 simulated stock paths. Plot on a single graph 10 simulated stock prices from time 0 to time T. Using Monte Carlo simulation, calculate the prices at time 0 of Call Options on this stock with strike prices K from $90 to $115. Recall that the payoff of a Call Option at maturity time T is given by the random variable V (T) = max(S(T) – K, 0) and the option price V (0) at time 0 is given by the Fundamental Theorem of Risk-Neutral Pricing: V (0) = e -rT E[V (T)]

```
```{r setup, include=FALSE}
knitr::opts_chunk$set(echo = TRUE)

 S <- 100
   sigma <- 0.4
   T <- 182.5
   r <- 0.03
   K<-98.5
   z<-rnorm(0,1)
   N <- 10000
   dt <- T/N
   ST <- S*exp((r-sigma^2/2)*T+sigma*sqrt(T)*z)
    payoff <- pmax(S-K,0)
   price <- exp(-r*T)*mean(payoff)

```

```{r cars}
summary(cars)
```

## Including Plots

You can also embed plots, for example:

```{r pressure, echo=FALSE}
plot(pressure)
```
```

Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.