3. Write a function `MCpaths(Nt,Np,mu,sigma,dt)` in R or Python to generate a set of simulated price paths for a stock following geometric Brownian motion. Use this function with expected annual return $\mu = 10\%$, standard deviation $\sigma = 30\%$, and initial price $S_0 = \$100$. Let the number of time steps per path be $N_t = 252$ and let the number of paths be N_p =10,000. (Include your own code with your submission.)

   (a) Plot a histogram of the *terminal values* of the paths. What are the mean and standard deviation of the distribution?

   (b) What is the average number of returns to the origin? That is, how many times, after the first step, does S_t hit or cross the initial value S_0?

   (c) Consider a one-year European call option on the stock with strike price $K = \$100$. What is the empirical mean value, averaged over all simulated paths, of the terminal payoff $C_{N_t} = \max(S_{N_t} - K, 0)$?

   (d) Now consider a one-year European put option, instead of a call, with the same strike price, $K = \$100$. What is the corresponding value? Should you evaluate the put option using the *same* random price prices used to evaluate the call above, or should a *new set* be drawn independently?