-Describe how to simulate the results of this strategy for the model given.

We need to generate random numbers to affect the stock prices. The total amount of months/random variables should be at 60. This is because there are 60 months in 5 years. We need 60 random variables. It will be denoted as U_i. The randomly generated numbers must be uniformly distributed. I will denote each random variable as $U_1, U_2, U_3, \ldots\ldots U_{60}$. Each month will affect Stock Prices. Stock prices will be denoted as $S_1, S_2, S_3, \ldots S_{60}$.

$$S_n \text{ will be determined by: } \begin{cases} 0.95S_{n-1} & \text{if } U_i < 0.25, \\ S_{n-1} & \text{if } U_i\ (>= 0.25 \text{ and } <= 0.75), \\ 1.05S_{n-1} & \text{if } U_i > 0.75. \end{cases}$$

Here's an example.

U(0,1)	Stock Price = 100 S_n	Account = 1000	Shares
U_1:0.04	95	1005	0
U_2:0.30	95	1010.02	0
U_3:0.18	90.25	1015.07	0
U_4:0.78	94.76	0	11.247
U_5:0.90	99.59	0	11.247
U_6:0.99	104.48	0	11.247
U_7:0.78	109.70	0	11.247
U_7:0.81	115.18	1295.43	0
...	This will continue to happen till the last month.	Regardless of the stock price. It must sell all shares at the 60th month.	
U_{60}:0.6	X	Account = (Shares)(X)	0

This pattern will continue till the last month. And on the last month we will have our final answer. To achieve a more accurate (representation/ simulation) of the strategy above. I need to run this simulation thousands of times.

-Determine number of simulation so the Monte Carlo study would attain the margin of error ±0.01 with probability 0.99.

α = 0.01. We need to divide that by 2. Thus getting Z(0.005) = 2.575.
Z = 2.575 is equivalent to 0.995
$N \geq 0.25\ (Z_{\alpha/2}\ /\varepsilon)$^2 = 0.25 (2.575 /0.01)^2 = 16,577

The number of simulations for the Monte Carlo study will be 16,577.

-How does this strategy compared to gains from the savings account for the same period of time? Determine success rate the above strategy related to gains from the savings account.

If we were to leave our money in the bank and let it accumulate interest over time. The final amount at the 60th month will be at 1348.85.
After running the Monte Carlo simulations 16,577 times. The success rate of achieving over 1348.85 is **23% or 0.23.**

The success rate is found using this formula.
Favourable outcomes are achieving over 1348.85 at the 60th month.
N = 16,577.

Number of **favourable** outcomes/n=The proportion of successes.

-Calculate 95% confidence interval for estimated strategy success rate.

Finding the 95% confidence interval.
α = (1-0.95)
α = 0.05
$\alpha/2$ = 0.025.
Z(0.025) = 1.96
The confidence interval will give the range of values that will allow us to be 95% certain that the interval contains the true mean of that population.

Sample P + -   (1.96)Square root ((Sample P (1-Sample P))/n)
(1.96)Square root (((0.23)(1-0.23))/16577))=0.00641
(0.23-0.00641) = 0.22359
(0.23+0.00641)= 0.23641

(0.22356,0.23641)

-Assume another investment strategy when you put money in stock when price drops below 100 dollars and sell these stocks when price is above 115 dollars.

```
Problems  Tasks  Console  Properties
<terminated> (exit value: 0) Porfolio Simulation.exe [C/(
This is the first strategy.
The variance is 81290.77
The stand deviation is 285.12
Average(Expected Value): 1159.11
Success rate is: 0.23

This is the second strategy.
The variance is 94413.36
The stand deviation is 307.27
Average(Expected Value): 1116.55
Success rate is: 0.26
```

-Is there a significant difference between two strategies?

After running the Monte Carlo simulations of 16,577.

Ho = U1 - U2 = 0

Ha = U1 - U2 ≠ 0

The sample n is large enough we can approximate that sample standard deviation. Using the results above.

SD1 = ((81290.77/16577)^2 /(16577-1)) = 0.00145

SD2 = ((94413.36/16577)^2 /(16577-1)) = 0.00196

We can find the degrees of freedom.

(81290.77/16577 + 94413.36/16577)^2 / (0.00145 + 0.00196) = 32945.62

But since the sample is so large and the degrees of freedom is so large. We can just use Z score.

Based on the table and α=0.05 and because this is a two tail test. **Z(1.96) = 0.05 and Z(-1.96).**

So the region of rejection lies beyond 1.96 and -1.96.

Test Statistics

T = [(X1 - X2) - d] /Standard Error.

Standard Error is sqrt[$(s_1^2/n_1) + (s_2^2/n_2)$]

Standard Error =sqrt(4.90 + 5.70) =3.2557

((1159.11-1116.55)-0)/3.2557 = 13.07

Since 13.07 lies a far beyond the rejection region of 1.96 and -1.96. The chances of H_0 is very low. Thus giving us evidence that allows us to reject the null hypothesis. The more likely H_A hypothesis is what we will accept. We can conclude that the difference is real and not by chance, thus there is a <u>significance</u> difference between the two strategies.

-Is it true that the difference between strategies is less than 50 dollars?

H_o = U1 - U2 >=50

H_A = U1 - U2 < 50

Since the degrees of freedom and the sample size is so large we can use Z score. Using the table. We can find the critical values. And since this is a one tail test. The Z score is Z(1.645) = **0.05** and because this is a left one tail test. Z(-1.645) = 0.05

Test statistic:

T = [(X1 - X2) - d] /Standard Error.

Standard Error is sqrt[$(s_1^2/n_1) + (s_2^2/n_2)$]

Standard Error =sqrt(4.90 + 5.70) =3.2557

((1159.11-1116.55)-50)/3.2557 = -2.285.

Since -2.285 lies beyond -1.645, in the region of rejection. There is evidence that allows us to reject the null hypothesis, and there is evidence that allows us to accept our hypothesis H_A. We can conclude that the difference between the two strategies is less than 50 dollars based on our results.