

# dbMagix©Exotic + EXCEL

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Please Select An Option Style

## **OPTIONS:**

### **MANU**

Black Scholes (European Option)

Asian Option Monte Carlo

Asian Option Approximation

Cash-or-nothing

Asset-or-nothing

Forward Start Option

Chooser Option

Options On Options

Spread Option

Floating Strike Lookback Option

Fixed Strike Lookback Option

Partial-time Floating Strike Lookback Option

Partial-time Fixed Strike Lookback Option

Gap Option

Two Asset Cash Or Nothing

Swaption

Vasicek

Binomial Tree

**Black-Scholes Formular:**

GO TO SHEET:

Please Select An Option Style

The call option value and put option value are calculated by following formulars:

**1.Black and Scholes (1973) Stock options:**

Please Select Option Type: put	
Asset price ( S )	100.00
Strike price ( K )	80.00
Time to maturity ( T )	1.00
Risk-free rate ( r )	6.00%
Volatility ( $\sigma$ )	35.00%
<b>Value:</b>	<b>3.56</b>

Call/Put Flag
p
2
call
put

**2.Merton (1973) Options on stock indices**

The **Merton (1973) option pricing formula** generalization the Black-Scholes (1973) formula so it can price European options on stocks or stc indices paying a known dividend yield. The yield is expressed as an annual continuously compounded rate  $d$ .

Please Select Option Type: put	
Asset price (index)( S )	100.00
Strike price ( K )	80.00
Time to maturity ( T )	1.00
Risk-free rate ( r )	6.00%
Divident Yield ( $\delta$ )	0.00%
Volatility ( $\sigma$ )	35.00%
<b>Value:</b>	<b>3.56</b>

Call/Put Flag
p
2
call
put

**3.Black (1976) Options on futures/forwards**

Here using the futures price as the stock price and setting the dividend yield to the risk-free rate.

Please Select Option Type: call	
Asset price (future)( F )	100.00
Strike price ( K )	80.00
Time to maturity ( T )	1.00
Risk-free rate ( r )	6.00%
Volatility ( $\sigma$ )	35.00%
<b>Value:</b>	<b>23.47</b>

Call/Put Flag
c
1
call
put

**4.Garman and Kolhagen (1983) Currency options**

Replace the dividend yield  $\delta$  with the foreign interest rate  $r_f$ .

Please Select Option Type: call	
Asset price (currency)( S )	100.00
Strike price ( K )	80.00
Time to maturity ( T )	1.00
Risk-free rate ( r )	6.00%
Foreign interest rate ( $r_f$ )	0.00%
Volatility ( $\sigma$ )	35.00%
<b>Value:</b>	<b>28.22</b>

Call/Put Flag
c
1
call
put

**5.The generalized Black and Scholes formula**

$b$ - is the cost of carry

Please Select Option Type: call	
Asset price ( S )	100.00
Strike price ( K )	80.00
Time to maturity ( T )	1.00
Risk-free rate ( r )	6.00%
Cost of Carry( b )	0.00%
Volatility ( $\sigma$ )	35.00%
<b>Value:</b>	<b>23.47</b>

Call/Put Flag
c
1
call
put

**Monte Carlo Simulation:**

**Asian Option**

An Asian option also called an average option is an option has a payoff that is based on the average price of the underlying asset over some period of time.

There are eight basic kinds of Asian options, which depending upon whether the option is a put or call, whether the average is computed as a geometric or arithmetic average, and whether the average asset price is used in place of the underlying asset or the strike price.

The importance of using **Monte Carlo simulation** on the Asian option pricing is the random number creating on the underlying asset prices. Suppose there are m averages, Monte Carlo simulation needs to simulate m stock prices S1,S2,... Sm, and average the m stock prices to get Savg , where Sm is defined as following:

$$S_m = S_{m-1} \times e^{\left(r-d-\frac{1}{2}\sigma^2\right)h+\sigma\sqrt{h}Z_m}$$

**Monte Carlo Simulation With Control Variate Method**

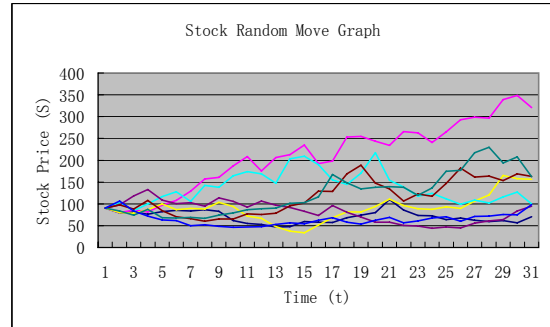
The idea of control variate method is to estimate the error on one trial of Monte Carlo simulation by using the price of a related option that does have a pricing formula. Then the error estimated from this control price can be used to improve the other Monte Carlo simulated prices.

Inputs Asian Option Parameters	
Stock Price (S):	90
Exercise Price (K):	86
Volatility (σ):	30.000%
Risk-free interest rate:	8.000%
Time to Expiration (T):	6
Dividend Yield (δ):	0.000%
Prices in Average (m):	30
No. of Simulation (N):	1000

GO TO SHEET:

Please Select An Option Style

Type/Method for Calculation	Average Selection	For Call	For Put
Geometric Average Close-form Calculation	Average Price	19.5836	4.57061
	Average Strike	28.7037	3.89966
Asian Option Using Simple Monte Carlo Simulation	Geometric Average Price	18.6602	4.97616
	Geometric Average Strike	23.3822	4.99036
	Arithmetic Average Price	21.7235	4.39367
	Arithmetic Average Strike	20.606	5.86003
Arithmetic Average Monte Carlo with Control Variate Method	Average Price	22.827	4.00675
	Average Strike	25.4208	4.59305



Time (Year)	Eight Simulated Stock Price in Different Time Interval							
	Stock 1	Stock 2	Stock 3	Stock 4	Stock 5	Stock 6	Stock 7	Stock 8
0	90	90	90	90	90	90	90	90
0.2	79.0065	80.2362	79.6398	103.2719375	97.3684	97.4627	83.681	106.084
0.4	81.7301	85.794	78.4608	84.46356094	118.195	87.814	74.1421	84.0012
0.6	75.9757	81.5165	86.8987	99.53362413	132.635	107.849	87.1894	72.1815
0.8	82.0784	97.1341	99.7828	116.7529592	108.827	84.0372	68.3168	63.3325
1	84.8438	107.905	86.9673	127.7874647	100.659	70.5542	67.3063	61.6492
1.2	83.4793	129.49	89.7795	105.6788388	102.847	65.971	69.0493	49.567
1.4	86.8824	157.225	88.0693	142.1938314	94.75	60.0402	66.8208	52.0704
1.6	83.1899	160.617	103.286	138.1884953	114.109	65.6088	74.372	48.5035
1.8	61.5425	186.852	93.8068	164.7422362	105.845	65.6208	79.5111	46.1066
2	55.2615	208.771	71.7759	173.6834746	92.348	77.3986	86.2584	47.067
2.2	52.937	175.696	66.6143	168.5011062	106.502	75.4278	88.8685	47.5547
2.4	46.9364	206.222	47.8897	147.2916207	96.7368	78.4737	90.0287	52.8727
2.6	47.8116	213.092	37.1521	203.5802502	91.9684	95.6968	101.066	56.546
2.8	59.7354	235.04	33.9264	209.2510815	82.7305	102.033	103.049	54.1013
3	58.0873	192.519	51.6831	190.2673173	73.433	129.437	115.618	62.2198
3.2	56.9398	197.841	68.0175	154.9545886	96.3892	128.806	167.563	68.4948
3.4	68.5406	253.327	81.4913	144.2751571	81.014	168.862	148.223	58.0792
3.6	74.3284	254.876	81.6732	170.0580434	69.9594	188.865	134.62	53.3749
3.8	80.2634	243.85	94.204	217.2166145	58.0147	147.48	138.007	62.4771
4	110.385	233.938	111.074	154.2601106	58.2381	134.007	139.593	68.8605
4.2	86.0299	265.702	95.9595	138.4874664	50.9316	106.433	138.213	56.437
4.4	73.7463	262.837	88.6928	117.4418154	49.5355	122.551	119.312	60.9215
4.6	72.7173	240.392	86.9901	124.1157671	44.0041	117.734	136.515	67.3757
4.8	63.9678	264.932	93.375	111.550688	47.335	147.142	174.501	70.6425
5	67.2378	292.725	89.5937	99.1339844	44.4143	182.021	176.719	60.0393
5.2	62.6056	298.946	106.417	108.3172192	55.8352	161.832	217.283	71.0491
5.4	59.3231	296.725	120.077	101.7714257	61.1053	163.452	229.553	71.9031
5.6	61.8329	338.756	165.386	115.9067091	63.9985	153.442	193.976	75.8397
5.8	56.1838	348.724	158.027	126.8898363	83.4238	169.033	207.657	74.781
6	70.5844	320.818	156.173	99.98321655	94.9782	163.042	161.856	98.3427