PROJECT REPORT

Q.1 Three stocks chosen are

a)Warner Bros. Discovery, Inc. (DISCA)
b)Apple
c)AT & T inc

Q.2 Binomial model to price the corresponding European call option with different strike price and expiry date

a)Value of Warner Bros. Discovery, Inc. (DISCA) using binomial model for different strike price

Stock Price	24.3
Strike Price	43
Time of maturity	2
Rate of interest	0.026
Volatility	0.511
Number of Steps	2
Option Type	European Call
Up factor(u)	1.666957
Down factor(d)	0.599895
dt	1
Risk Neutral Probability	0.399645
1-p	0.600355
European Call Value	Different Strike Prices
11.59704 (Actual value is 11.82)	45

12.13644	45
11.59704	43

b)Value of Apple stock using binomial model for different strike price

Stock Price	170
Strike Price	178
Time of Maturity	2
Rate of Interest	0.026
Volatility	0.2853
Number of Steps	2
Option Type	European Call
Up factor(u)	1.33061
Down factor(d)	0.751789
dt	1
Risk Neutral Probability	0.474698
1-p	0.525302
European Call	Different Strike Prices
29.29432(Actual Value is 35..80)	178

29.62347	180
29.95262	182

c)Value of AT & T inc stock using binomial model for different strike price

Stock Price	24.14
Strike Price	23
Time of Maturity	2
Rate of Interest	0.026
Volatility	0.1721
Number of Steps	2
Option Type	European Call
Up factor(u)	1.187797
Down Factor(d)	0.841895
dt	1
Risk Neutral Probability	0.533232
1-p	0.466768
European Call	Different Strike Prices
2.550776 (Actual value is 8.85)	23

3.327099	30
2.772583	25

Q.3 Using Black Scholes equation value of European Call options

	AT & T inc	Disca	Apple
Stock Price(S)	24.14	24.43	170
Strike Price(K)	30	45	180
Rate of Interest(r)	0.026	0.026	0.026
Time of Maturity(T)	2	2	2
Volatility(Std. Deviation)	0.1721	0.51	0.285
Variance	0.029618	0.2601	0.081225
ln(S/k)	-0.21733	-0.61085	-0.05716
[r+0.5(variance)]*T	0.081618	0.3121	
Std Dev *Sqrt(T)	0.243386	0.721249	0.0403051
d1	-0.55759	-0.41421	0.188727
N(d1)	0.288563	0.339359	0.574847
d2	-0.80097	-1.13546	-0.21432

N(d2)	0.211574	0.128091	0.415147
K/e^rT	28.47987	42.7198	170.879196
Value of Call Option	0.940328	2.818524	26.78389

	Call option value by Binomial model	Call option value by Black-Scholes model	Strike Price	Difference b/w value obtained from both model
Apple	29.62347	26.78389	180	2.83958
Disca	11.59704	2.818524	45	8.778516
AT & T inc	2.550776	0.940328	30	1.610448

Q.4 Black Scholes formula is limiting case of Binomial model as n goes to infinity its approaches the black scholes call option value

a)Value Using Binomial with high n

Stock Price	24.3
Strike Price	45
Time of maturity	2
Rate of interest	0.026
Volatility	0.511
Number of Steps	50
Option Type	European Call
Up factor(u)	1.107604971
Down factor(d)	0.902848964
dt	0.04
Risk Neutral Probability	0.479554074
1-p	0.520445926

European Call	Strike Price
2.342103	45

a)Same Value Using Black Scholes formula

Stock Price(S)	24.43
Strike Price(K)	45
Rate of interest(r)	0.026
Time of maturity(T)	2
Volatility(Std. Dev.)	0.51
Variance	0.2601
ln(S/K)	-0.61085
[r+0.5(Variance)]*T	0.3121
Std dev *sqrt(T)	0.721249
d1	-0.41421
N(d1)	0.339359
d2	-1.13546
N(d2)	0.128091
K/e^rT	42.7198
Value of call option	**2.818524**

So the call option value calculated by binomial model and block-scholes model are near to each other as n value increases in binomial model.

Q.5 Value of Delta for every week of three stocks

Date	Strike Price	Volatility	Value of Call option	Delta=N(d1)
TCS				
08-Apr-22	3,700.00	0.026	1.4977E-42	8.12028E-43
07-Apr-22	3,700.00	0.026	3.43996E-41	1.73153E-41
06-Apr-22	3,700.00	0.026	4.09441E-35	1.4511E-35
05-Apr-22	3,700.00	0.026	5.12071E-30	1.31333E-30
04-Apr-22	3,700.00	0.026	3.11031E-33	9.81742E-34
01-Apr-22	3,700.00	0.026	3.24967E-35	1.15874E-35
31-Mar-22	3,700.00	0.026	9.65558E-36	3.55396E-36
INFOS				
08-Apr-22	1,900.00	0.30	2.365E-44	4.1056E-44
07-Apr-22	1,900.00	0.30	5.60162E-43	8.95583E-43
06-Apr-22	1,900.00	0.30	1.71768E-39	2.21274E-39
05-Apr-22	1,900.00	0.30	1.01237E-34	9.52246E-35
04-Apr-22	1,900.00	0.30	5.18832E-32	4.03544E-32
01-Apr-22	1,900.00	0.30	6.12526E-29	3.79536E-29
31-Mar-22	1,900.00	0.30	5.39788E-27	2.87475E-27
SBI				
08-Apr-22	520	0.35	1.14227E-24	2.50927E-24
07-Apr-22	520	0.35	3.33383E-23	6.34991E-23
06-Apr-22	520	0.35	2.62177E-25	6.11958E-25
05-Apr-22	520	0.35	7.19662E-28	2.12358E-27

04-Apr-22	520	0.35	1.02319E-24	2.25799E-24
01-Apr-22	520	0.35	2.25746E-26	5.81815E-26
31-Mar-22	520	0.35	6.7391E-30	2.37312E-29

Q.6 Justification for why prices have different value for market and value obtained by using formula Ans:

Results using the Black–Scholes/Binomial model differ from real world prices because of simplifying assumptions of the model.

One significant limitation is that in reality security prices do not follow a strict stationary log-normal process, nor is the risk-free interest actually known and is not constant over time.