

In [4]:

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import math

T=5
sigma=0.3
r=0.05
K=105
S0=100

def auxiliary_put(Pri):
    if (Pri<=K):
        return (K-Pri)
    elif (Pri>K):
        return 0

def auxiliary_call(Pri):
    if (Pri>=K):
        return (-K+Pri)
    elif (Pri<K):
        return 0

def fact(i):
    prod=1
    while i>1:
        prod=prod*i
        i=i-1
    return prod

def Price(m,a,b,f):
    Price_c=S0
    Price_w=pow(a,m)*pow(b,f-m)
    Price_c=Price_c*Price_w
    return Price_c

def combination(i,r):
    k_1=fact(i)
    k_2=fact(i-r)*fact(r)
    k_1=k_1/k_2
    return k_1

M=[1,5,10,20,50,100,200,400]
call=[]
put=[]

def main(f):
    delta=T/f
    delta_1=math.sqrt(delta)
    a=math.exp(sigma*delta_1+(r-(sigma*sigma)/2)*delta)
    b=math.exp(-sigma*delta_1+(r-(sigma*sigma)/2)*delta)
    p=((math.exp(r*delta))-b)/(a-b)
    q=1-p
    base=1/(math.exp(r*T))
    sum_1=0
    sum_2=0
    for m in range(f+1):
        price_o=Price(m,a,b,f)
        price=auxiliary_call(price_o)
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price=price*combination(f,m)
price=price*pow(p,m)*pow(q,f-m)
sum_1=sum_1+price
price_o=Price(m,a,b,f)
price=auxiliary_put(price_o)
price=price*combination(f,m)
price=price*pow(p,m)*pow(q,f-m)
sum_2=sum_2+price
sum_1=sum_1*base
sum_2=sum_2*base
call.append(sum_1)
put.append(sum_2)

for k in M:
    main(k)

for m in range(len(M)):
    print("For the value of M =",M[m])
    delta_8=T/M[m]
    delta_11=math.sqrt(delta_8)
    alpha=math.exp(sigma*delta_11+(r-(sigma*sigma)/2)*delta_8)
    beta=math.exp(-sigma*delta_11+(r-(sigma*sigma)/2)*delta_8)
    if (alpha>math.exp(r*delta_8)) and (math.exp(r*delta_8)>beta):
        print(' The call price at time 0 =',call[m],', The put price at time 0 =',put[m])
        print(' ')
        print(' ')
    else :
        print('The noo arbitrage condition violated for M =',M[m])

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For the value of $M = 1$

The call price at time 0 = 38.16763502522771 , The put price at time 0 = 19.94171724772521

For the value of $M = 5$

The call price at time 0 = 34.90653251138065 , The put price at time 0 = 16.68061473387813

For the value of $M = 10$

The call price at time 0 = 33.62502175314767 , The put price at time 0 = 15.399103975645172

For the value of $M = 20$

The call price at time 0 = 33.85944948849383 , The put price at time 0 = 15.633531710991278

For the value of $M = 50$

The call price at time 0 = 33.98118436571939 , The put price at time 0 = 15.755266588217449

For the value of $M = 100$

The call price at time 0 = 34.01116098479097 , The put price at time 0 = 15.785243207287463

For the value of $M = 200$

The call price at time 0 = 34.01957870440791 , The put price at time 0 = 15.793660926904382

For the value of $M = 400$

The call price at time 0 = 34.019131769005824 , The put price at time 0 = 15.79321399150641

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