Problem 1

Thursday, October 17, 2024 8:39 PM

a)

Part 1a		
Notional Value	$1,000.00	
Annual Coupon rate	8%	
Issued years ago	3.5	
Matuarity	5.5	
Risk free rate	4.50%	
Chash Flow		
Year	Cash	PV
0.5	80	78.25856
1.5	80	74.88857
2.5	80	71.66371
3.5	80	68.57771
4.5	80	65.6246
5.5	1080	847.7819
Total Value	$1,206.80	

Part 1a		
Notional Value	1000	
Annual Coupon rate	0.08	
Issued years ago	3.5	
Matuarity	5.5	
Risk free rate	0.045	
Chash Flow		
Year	Cash	PV
0.5	=D5*D6	= D15/((1+$D$9)^C15
1.5	=D5*D6	= D16/((1+$D$9)^C16
2.5	=D5*D6	= D17/((1+$D$9)^C17
3.5	=D5*D6	= D18/((1+$D$9)^C18
4.5	=D5*D6	= D19/((1+$D$9)^C19
5.5	=D5*D6 + D5	= D20/((1+$D$9)^C20
Total Value	=SUM(E15:E20)	

The present value of the bond is $1206.80

b) Used python to solve equation for r

$$1028.50 = \sum_{t}^{n} \frac{P_t}{(1+r)^t}$$

```python
from scipy.optimize import fsolve

def bond_price_equation(r):
    price = 1028.50
    cash_flows = [80, 80, 80, 80, 80, 1080]
    times = [0.5, 1.5, 2.5, 3.5, 4.5, 5.5]

    # Calculate the sum of the discounted cash flows
    discounted_cash_flows = sum(cash_flow / (1 + r) ** time for cash_flow, time in zip(cash_flows, times))
    return discounted_cash_flows - price

# Use fsolve to find the value of r (the internal yield of return)
initial_guess = 0.05
ytm_solution = fsolve(bond_price_equation, initial_guess)

print(ytm_solution[0] * 100 ) # Return YTM as a percentage
```

The intcrual geild of return is 8.25 %

c)

The companies financial healt as improved. Even though it is trading below present value The credit spread has decreased. Initially the company had to pay a high premium, 8% in a 2% risk free interest rate enviornment, Δ 8% − 2% = 6%. Today the credit spread is Δ 8.25% − 4.5% = 3.75%. This shows a increase in investor confidence.

Problem 2

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Problem 2						
Notional Principle	$ 100,000,000.00					
Semiannual fixed rate	3%					
Remainin life (Months)	20					
Previous 6 month IBOR fixed	4%					
IBOR Forward rates (Months)						
2 to 8	4.50%					
8 to 14	4.85%					
14 to 20	5.25%					
Payment Date	Floating Payment	Fixed Payment	Net Cash flow	OIS Rates Continous (Months	Discount Factor	PV
2	$ 2,000,000.00	$1,500,000.00	$ 500,000.00	3.25%	0.994597977	$ 497,298.99
8	$ 2,250,000.00	$1,500,000.00	$ 750,000.00	3.75%	0.975309912	$ 731,482.43
14	$ 2,425,000.00	$1,500,000.00	$ 925,000.00	4%	0.95440548	$ 882,825.07
20	$ 2,625,000.00	$1,500,000.00	$1,125,000.00	4.25%	0.931617149	$1,048,069.29
					Swap Value	$3,159,675.78

Problem 2						
Notional Principle	100000000					
Semiannual fixed rate	0.03					
Remainin life (Months)	20					
Previous 6 month IBOR fixed	0.04					
IBOR Forward rates (Months)						
2 to 8	0.045					
8 to 14	0.0485					
14 to 20	0.0525					
Payment Date	Floating Payment	Fixed Payment	Net Cash flow	OIS Rates Continous (Months)	Discount Factor	PV
2	=I8*I5*0.5	=$I$6*$I$5*0.5	=I17-J17	0.0325	=EXP(-L17*(H17/12))	= K17*M17
8	=I11*$I$5*0.5	=$I$6*$I$5*0.5	=I18-J18	0.0375	=EXP(-L18*(H18/12))	= K18*M18
14	=I12*$I$5*0.5	=$I$6*$I$5*0.5	=I19-J19	0.04	=EXP(-L19*(H19/12))	= K19*M19
20	=I13*$I$5*0.5	=$I$6*$I$5*0.5	=I20-J20	0.0425	=EXP(-L20*(H20/12))	= K20*M20
					Swap Value	=SUM(N17:N20)

The total Value of the swap is

$ 3,159,675.78

Problem 3

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Problem 3				
Bid Price	$ 100.00		Forward Price	$ 97.47
Ask Price	$ 102.00			
Risk Free interest Rate	4.50%		Adjusted Spot Price	$ 95.18
Dividend Payment	$ 6.00			
Time to Maturity (years)	3.00			
Payment Schedule Div				
Time (Years)	PV			
0.5	$ 5.87			
1.5	$ 5.61			
2.5	$ 5.36			
Total	$ 16.84			

Problem 3				
Bid Price	100		Forward Price	=(D29-D40)*EXP(D30*D32)
Ask Price	102			
Risk Free interest Rate	0.045		Adjusted Spot Price	= (D28-D40)*EXP(D32*D30)
Dividend Payment	6			
Time to Maturity (years)	3			
Payment Schedule Div				
Time (Years)	PV			
0.5	= $D$31*EXP(-$D$30*C36)			
1.5	= $D$31*EXP(-$D$30*C37)			
2.5	= $D$31*EXP(-$D$30*C38)			
Total	=SUM(D36:D38)			

a) If the client wants a long position in the forward the financial institution should quote a forward price $97,50

b) If the client wants a short position in the forward the finacial institution should quote a forward price $ 95,18

Problem 4

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a) Put call parity,

$$c + Ke^{-rt} = P + S_0$$

$$\Rightarrow c = P + S_0 - Ke^{-rt}$$

Problem 4		
stock Price		100
Risk free rate(continous)		4%
Time to experiation(year)		1
European put option 1		
Strike Price	$	90.00
Premium	$	5.65
European put option 2		
Strike Price	$	110.00
Premium	$	15.25
Call option premium 2	$	9.56
Total Cost for Strangle	$	15.21
Lower Break Even	$	74.79
Upper Break Even	$	125.25

Problem 4	
stock Price	100
Risk free rate(continous)	0.04
Time to experiation(year)	1
European put option 1	
Strike Price	90
Premium	5.65
European put option 2	
Strike Price	110
Premium	15.25
Call option premium 2	=J27+J37-(J36*EXP(-J28*J29))
Total Cost for Strangle	=J33+J39
Lower Break Even	= J32-J42
Upper Break Even	=J36+J37

a) The total cost of setting up the long strangle is \$15.21

b) Profit = Payoff$_{put}$ + Payoff$_{call}$ − Total cost

where

$$\text{Payoff put} = \max(K_1 - S_T, 0)$$

$$\text{Payoff call} = \max(S_T - K_2, 0)$$

The lower breaking Even point is 74.79 and tu upper break even point is 125.25

Problem 5

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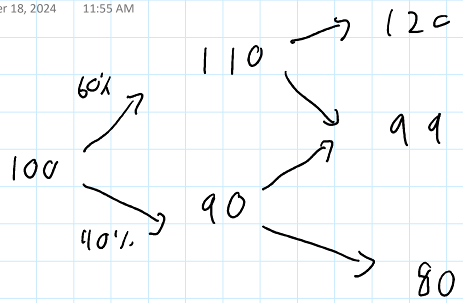

Find the implied risk neutral rate, p is improving world, and $1-p$ is decreasing world

The current price should be the expected price under the risk neutral measure

Thus,

$$100 = p \cdot 120 + (1-p)\, 80$$

$$100 = 120p + 80 - 80p$$

$$p = \frac{1}{2}$$

In a improving world the payoff will be $110 - 100 = 10$
and if the world worsen the payoff will be 0

Expected payoff,

$$E(P) = p \cdot 10 + p \cdot 0 = \frac{1}{2} \cdot 10 + 0 = 0$$

the expected payoff for the one month call option on S_h strike price is \$ 5

Problem 6

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Current stock : \$100
Strike price : \$82
Time to maturity : 1 year
Time steps : 2
Risk free rate : 4,5% annual contious compounding
σ : 32%

CRR model :

$$u = e^{\sigma\sqrt{\Delta t}}, \quad d = e^{-\sigma\sqrt{\Delta t}} = \frac{1}{u}$$

$$u = e^{0,32\sqrt{\frac{1}{2}}} = 1,259$$

$$d = \frac{1}{u} = \frac{1}{1,28} = 0,797$$

Risk Neutral Probability :

$$p = \frac{e^{r\Delta t} - d}{u - d} = \frac{e^{0,045 \cdot 0,5} - 0,797}{1,259 - 0,797} \approx 0,4935$$

$$1 - p = 0,5065$$

$$\begin{array}{ccccc} & & & & 102,4 \cdot 1,25 = 125,78 \\ & & 80 \cdot 1,25 = 103,1 & \nearrow & \\ & \nearrow & & \searrow & \\ 80 & & & & 80,00 \\ & \searrow & & \nearrow & \\ & & 80 \cdot 0,797 = 63,80 & \searrow & \\ & & & & 62,4 \cdot 0,797 = 50,88 \end{array}$$

Pay off ,

$$P_{uu} = \max(K - S, 0) = \max(82 - 125,78) = 0$$

$P_{uu} = \max(K - S, 0) = \max(82 - 125{,}78) = 0$

$P_{ud} = \max(82 - 80) = 2$

$P_{dd} = \max(82 - 50{,}88) = 31{,}12$

Expected value european:

$V_u = e^{-0{,}045 \cdot 0{,}5}(0 + 0{,}5065 \cdot 2) = 0{,}99$

$V_d = e^{-0{,}045 \cdot 0{,}5}(0{,}4935 \cdot 2 + 0{,}5065 \cdot 31{,}12) = 16{,}38$

Option price:

$V_0 = e^{-0{,}045 \cdot 0{,}5}(0{,}4935 \cdot 0{,}99 + 0{,}5065 \cdot 16{,}38) = 8{,}59$

The value for 1 year option put is 8,54

b) $P_{exercise} = \max(K - S_0, 0) = \max(82 - 103{,}1) = 0$

From a) we know that $V_u = 0{,}99$

Thus $V_u > P_{exercise}$

For the down node,

for one time step from a V_d is 63,80

$Pay\text{-}off = \max(82 - 63{,}80) = 18{,}20$

From a the value V_d is 16,87

Thus payoff $> V_d$

Thus payoff $> V_f$

At present the value is,

$$e^{-0.048 \cdot 0.5}(0.49 \cdot 16.37 + 0.5164 \cdot 18.20) = 9.49$$

The 1 year american put value is 9,49