Homework #1

1.1) Spot price S0 = $5,050
Risk-free rate r = 3.5%

forward price (F0) = 5050*1.035 = 5226.75

(i) Forward price = $5,200 is less than F0
Therefore arbitrage exists

(ii) Forward price = $5,300 is more than1 F0
Therefore arbitrage does not exists

Profit = 5300 − 5226.75 = $73.25

1.2) Given:
Interest rate = 3.25% with semi-annual compounding

i) Annual interest rate
(1 + 0.0325/2)^2 = 1.032764
r = 3.2764%

ii) Quarterly compounding:
(1 + r/4)^4 = 1.0328
r = 3.28%

iii) Continuous compounding:
r = ln(1.0328) = 3.227%

1.3) Balance = $10,000
APR = 17.15%
Daily compounding (365 days)
Time = 30 days

Balance after 30 days:
10000*(1 + 0.1715/365)^30 = $10,141.00

1.4) Bond B1 Details:
Face Value = $100
Coupon Rate = 5% annually, paid semi-annually
Coupon per period = 5% × 100 / 2 = $2.50
Maturity = 2 years

Zero Rates from Table:
R(T) = 3.00% for maturities up to 1 year
R(T) = 3.50% for maturities between 1 and 2 years

Present Value Calculations:

PV(0.5) = 2.50 / (1.03)^0.5 = 2.463
PV(1.0) = 2.50 / (1.03)^1.0 = 2.427
PV(1.5) = 2.50 / (1.035)^1.5 = 2.375
PV(2.0) = 102.50 / (1.035)^2 = 93.445

Bond Price:
2.463 + 2.427 + 2.375 + 93.445 = $100.71

Yield Calculations:

2.50e^(-y*0.5)+ 2.50 e^(-y*01)+ 2.50 e^(-y*1.5)+ 102.50 e^(-y*2) = 100.71

Bond Price = $100.71
Yield = 4.64%

Bond B2:
Bond B2 Details:
Face Value = $100
Coupon Rate = 6% annually, paid semi-annually
Coupon per period = 6% × 100 / 2 = $3.00
Maturity = 10 years (20 semi-annual periods)

Cash Flows:
Periods 1–19: $3.00 each period
Period 20: $103.00 (coupon + principal)

Present Value Calculations (using zero rates):

PV(0.5) = 3.00 / (1.03)^0.5
PV(1.0) = 3.00 / (1.03)^1.0
PV(1.5) = 3 / (1.035)^1.5

PV(2)   = 3 / (1.035)^2
PV(2.5)= 3 / (1.0425)^2.5
PV(3)   = 3/ (1.0425)^3
PV(3.5) = 3/ (1.0425)^3.5
PV(4)   = 3/ (1.0425)^4
PV(4.5) = 3/ (1.0425)^4.5
PV(5)   = 3/ (1.0425)^5
PV(5.5)   = 3/ (1.045)^5.5
PV(6)   = 3/ (1.045)^6
PV(6.5)   = 3/ (1.045)^6.5
PV(7)   = 3/ (1.045)^7
PV(7.5)   = 3/ (1.045)^7.5
PV(8)   = 3/ (1.045)^8
PV(8.5)   = 3/ (1.045)^8.5
PV(9)   = 3/ (1.045)^9
PV(9.5)   = 3/ (1.045)^9.5
PV(10.0) = 103.00 / (1.045)^10

Bond Price:
Sum of discounted cash flows ≈ $108.90

Yield Calculation
3e^(-y*0.5)+ 3e^(-y*01)+ 3e^(-y*1.5)+ 3e^(-y*2)+ 3e^(-y*2.5)+ 3e^(-y*3)+ 3e^(-y*3.5)+ 3e^(-y*4)+ 3e^(-y*4.5)+ 3e^(-y*5)+ 3e^(-y*5.5)+ 3e^(-y*6)+ 3e^(-y*6.5)+ 3e^(-y*7)+ 3e^(-y*7.5)+ 3e^(-y*8)+ 3e^(-y*8.5)+ 3e^(-y*9)+ 3e^(-y*9.5)+ 102.50 e^(-y*10) = 108.90

y = 4.47%

1.5) Notional = €1,000,000
Forward rate = 1.150
Spot rate = 1.100
Spot at maturity = 1.175

(i) Gain/Loss:
Hedged payment = $1,150,000
Unhedged payment = $1,175,000
Loss (opportunity cost) = $25,000

(ii) Interest rate differential:
USD – EUR = ln(1.150 / 1.100)
=S 4.44% (annualized)