

Math 210, Spring 2022

Problem Set # 7

Due March 23, 2021 at 11:59pm on Gradescope

Question 1. The futures price on gold takes the following values over the next five days:

Day	$\Phi(t, T)$	MTM	Margin@open	payment	Margin@close
0	2100				
1	2000				
2	2050				
3	1900				
4	2000				
5	2150				

Suppose the initial margin requirement is 10%, with maintenance margin requirement 5%. Ignoring interest, how much money do you make or lose if you enter one futures contract, then:

- Exit the futures contract the first time you get margin called.
- Post additional margin when required and exit the futures contract on day 5.

Question 2. Assume the continuously compounded interest rate has constant value 12%. The table below is for a futures contract maturing on day 6 with delivery price equal to the futures price. The underlying asset is a stock paying no income. The S_t column gives the stock price on each day. The $\Phi(t, T)$ column gives the futures price on each day. Assume $T = \text{day } 6$. The MTM column lists the mark-to-market payments. The interest column lists the interest that will be accrued on the mark-to-market payment by the maturity date.

Fill in the table. Give at least four decimal places.

day	S_t	$\Phi(t, T)$	MTM	interest
0	1900			
1	2000			
2	2100			
3	2200			
4	2000			
5	2100			
6	2050			
		sum:		

Hint: Use Mathematica or a spreadsheet (i.e. Excel) for the calculations.

Question 3. (10pts Bonus, not required) As we defined in class, a FRA with maturity T , term length α and fixed rate K exchanges payments of $\alpha L_T[T, T + \alpha]$ and αK at time $T + \alpha$. The *forward libor rate* $L_t[T, T + \alpha]$ is the fixed rate K which makes this contract have value zero at time t .

Now consider a FRA which exchanges payments of $\alpha L_T[T, T + \alpha]$ and αK just like above, but does so at time T instead of time $T + \alpha$. Is the forward libor rate for the FRA which pays at time T higher or lower than the forward libor rate for the FRA which pays at time $T + \alpha$?