FINM 37500 Final Exam

Fixed Income Derivatives

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- This exam is **closed book** and **closed notes.**
- You are **not** allowed any electronics or calculator.

Section	Questions	Points per Question	Points Awarded	Points Possible
1	13	2		26
2	13	3		39
3	13	3		39
Total	39	-		**104**

1 True or False

1. All else being equal, a callable bond has a higher price than a regular bond.

   ☐ True
   ☒ False

2. A caplet increases in value when the forward rate increases:

   ☒ True
   ☐ False

3. A receiver swaption increases in value when the forward swap rate increases:

   ☐ True
   ☒ False

4. All else equal, and for the same strike and forward period, a receiver swaption is less valuable than a forward starting floor.

   ☒ True
   ☐ False

5. The relationship between swaption implied volatility and caplet/floorlet implied volatilities depends on the correlation between the forward rates.

   ☐ True
   ☒ False

6. Treasury futures are settled only at expiration, unlike forwards which have daily mark-to-market adjustments.

   ☐ True
   ☒ False

7. The yield curve has no impact on Treasury futures pricing since they are based purely on spot Treasury bond prices.

   ☐ True
   ☒ False

8. The implied repo rate in Treasury futures represents the return from financing a bond purchase in the repo market versus using a futures contract.

   ☒ True
   ☐ False

9. A cap which can be priced using flat volatilities must have a flat term structure of forward volatilities.

☐ True
☒ False

10. The forward bond price increases if forward volatilities increase, all else equal.

☐ True
☒ False

11. The $0 \to t$ forward bond price is higher than the spot price if the coupon rate is higher than all forward rates.

☐ True
☒ False

12. For a treasury future, the eventual time T cheapest-to-deliver (CTD) bond has zero time-t net basis.

☐ True
☒ False

13. Gross basis converges to zero for the CTD bond at the time of expiration / delivery.

☒ True
☐ False

2 Multiple Choice

Circle the bullet point of exactly ONE answer.

1. The option adjusted spread (OAS) measures

- the model volatility such that the market price equals the model price.
- the difference between the model price assuming a lognormal distribution and the model price assuming a normal distribution.
- the difference between the callable bond's price and the forward bond price.
- (•) the difference between the model price and the market price as a rate of excess return.

2. For a quarterly caplet or floorlet with payment at time T, the forward volatility refers to

- the volatility of the forward rate from now until $T - 0.25$.
- (•) the volatility of the forward rate from now until T.
- the future volatility of the forward rate in some given forward period.
- the future volatility of the discount rate in some given forward period.

3. For a cap or floor, an analogy might be that

- the flat volatility is to discount rate as the forward volatility is to YTM.
- the flat volatility is to discount rate as the forward volatility is to forward rate.
- the flat volatility is to YTM as the forward volatility is to discount rate.
- the flat volatility is to YTM as the forward volatility is to forward rate.

4. Consider a 1-by-4 payer-swaption versus a 1-year forward, 4-year cap. For a given strike,

- ☐ They have equal value.
- ☐ The swaption has higher value.
- ☐ The forward cap has higher value.
- ☐ It is indeterminate.

5. Which of the following is NOT a key difference between forwards and Treasury futures?

- ☐ Treasury futures have credit risk
- ☐ Treasury futures are standardized, while forwards are customizable
- ☐ Treasury futures are traded on exchanges like the CBOT
- ☐ Treasury futures require margin

6. Basis trading with Treasury futures involves:

- ☐ Exploiting price differences between cash Treasuries and their corresponding futures contracts
- ☐ Arbitraging the difference between two Treasury futures contracts
- ☐ Using interest rate swaps to hedge Treasury futures positions
- ☐ Speculating on Federal Reserve rate changes

7. Suppose a borrower has a floating-rate loan and wants to hedge against interest rate increases. Which of the following trades would best hedge this exposure?

- ☐ Buy an interest rate floor
- ☐ Sell an interest rate floor
- ☐ Buy an interest rate cap
- ☐ Sell an interest rate cap

8. Suppose one has the following portfolio...

- long par bond
- long ATM cap
- short ATM floor

This portfolio is most similar to which of the following?

- ☐ A fixed-rate bond
- ☐ A floating rate note

- ☐ An ATM receiver swaption
- ☐ An ATM payer swaption

9. Which of the following is the ATM strike for a T-expiration **caplet / floorlet**...

- ☐ The T spot rate.
- ☐ The T forward rate.
- ◉ The T swap rate.
- ☐ The T forward swap rate.

10. Which of the following is the ATM strike for a T-expiration **cap / floor**...

- ☐ The T spot rate.
- ☐ The T forward rate.
- ◉ The T swap rate.
- ☐ The T forward swap rate.

11. Which of the following is the ATM strike for a T-expiration **swaption**...

- ☐ The T spot rate.
- ☐ The T forward rate.
- ☐ The T swap rate.
- ◉ The T forward swap rate.

12. A long SOFR futures contract has...

- ◉ Positive convexity
- ☐ Negative convexity
- ☐ No convexity

13. A long Treasury futures contract has...

- ◉ Positive convexity
- ☐ Negative convexity
- ☐ No convexity

3 Check All That Apply (if any)

Check the tick box for every true answer (and leave false answers unchecked.)

1. There exists a put-call parity relationship between:

- ☑ caps, floors, and swaps.
- ☑ caplets, floorlets, and FRAs.

- ☐ caps, floors, and swaptions.
- ☐ caplets, floorlets, and swaptions.
- ☐ swaptions and swaps.
- ☑ swaptions and forward swaps.

2. Black's formula assumes:

- ☑ the underlying is a tradable security.
- ☑ a lognormal distribution for the underlying as of expiration.
- ☐ a normal distribution for the underlying as of expiration.
- ☐ the underlying has no cash flows.

3. A European callable bond has:

- ☑ strictly negative convexity.
- ☐ positive or negative convexity.
- ☑ lower duration than a non-callable version of the same bond.
- ☐ a maximum theoretical value.

4. A treasury future CTD is a cash bond that:

- ☑ is in the future's deliverable basket.
- ☐ has the largest implied repo rate.
- ☐ has the largest net basis.
- ☐ has the a price lower than the futures price.

5. Net basis of a bond is calculated as... → fwd price − future $F_{t\mapsto T} - \psi^i F_{t\mapsto T}$ } none of the options!

- ☐ the future price minus the spot price
- ☐ the future price minus the forward price
- ☐ the forward price minus the spot price
- ☐ the future price minus the spot price and minus basis
- ☐ the future price minus the forward price and minus basis

6. Consider forward volatility vs flat volatility with regard to a T-horizon cap.

- ☐ both accurately price any given caplet.
- ☑ both accurately price the cap
- ☑ flat vol misprices every caplet
- ☑ forward vol accurately prices every caplet

7. The value of a 1-year forward of a 4-year treasury bond is INCREASING (as a function) in...

- ☑ the spot price of the 5-year treasury.

- ☐ the coupon rate of the bond.
- ☑ the spot rate from $t = 0$ to $t = 1$.

8. The value of a T-year floor is INCREASING (as a function) in...
   - ☐ T.
   - ☑ forward volatilities.
   - ☑ flat volatilities.
   - ☑ strike
   - ☐ forward interest rates

9. A STIR futures contract price is commonly used as an estimated forward rate with the following adjustments.
   - ☑ subtract from 100 to convert price convention to rate convention
   - ☐ use SABR to correct for volatility skew
   - ☑ add/subtract a convexity adjustment to account for daily settlement

10. Which of the following implies arbitrage between a 3-month-to-expiration treasury future and a deliverable bond?
    - ☐ positive gross basis
    - ☐ negative gross basis
    - ☐ positive net basis
    - ☑ negative net basis
    - ☑ positive implied repo rate
    - ☐ negative implied repo rate

11. Binomial trees of interest rates, such as that provided to you in the homework, are calibrated to...
    - ☐ perfectly fit discount factors
    - ☑ approximately fit discount factors
    - ☑ perfectly fit forward volatilities
    - ☐ approximately fit forward volatilities

12. Binomial trees can price which of the following styles of callable bonds?
    - ☑ european
    - ☑ american
    - ☑ bermudan

13. Adapting Black's formula to various fixed income derivatives requires care. For instance, we must plug in a time-to-expiration that does not match the true time-to-expiration for which of the following?
    - ☐ call option on a bond
    - ☑ caplet
    - ☑ swaption