

FINM 37500 Final Exam Solutions

Fixed Income Derivatives

March 12, 2025

Name: _____

UChicago ID: _____

- 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

Credit for either answer, as the specification of the trade is a bit ambiguous.

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 $0 \rightarrow t$ 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

Credit for any answer, as the question is underspecified. Positive convexity for the bond-like behavior, but small negative convexity due to the embedded optionality retained by the short position with regard to delivery. Quantitatively, should be net positive 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...
 - ✗ 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 $t = 1$.
- Not grading whether the first statement is checked. Though the question intends for the first statement to be interpreted holding all else equal, there may be confusion as to considering how a change in the corresponding forward rate would impact the price.
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
- Ignoring whether the final answer is checked, as the statement is under-specified.
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