

FINM 37500 Final Exam**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
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

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 $t = 1$.
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