No calculators. Total points on exam: 100. Look over the entire exam before you begin. If I ask you to "explain," your grade for the question will depend on your explanation. If I ask you to figure out a number, show your work. Good luck!

1) Consider a zero-coupon bond that you buy today, in March 2021, for a price P_t. The bond will pay $1000 thirty years from today, in March 2051. Ten years from today, in March 2031, you sell the bond for a price P_{t+10}.

a) 5 pts Write down a formula
(do not solve it) that defines the
bond's yield in March 2021.

b) 5 pts Write down (do not solve)
a formula that defines the bond's
yield in March 2031.

c) 5 pts Write down (do not solve)
a formula that defines the rate of
return you receive from buying the
bond in 2021 and selling it in 2031.

2) Consider a coupon bond that you can buy today in March 2021. The bond will make coupon payments once a year, in March 2022, March 2023, March 2024, and also pays off its face value (or principle) in March 2024. The face value is $500. The coupon rate is 5% ("%" means percent). You look on your Bloomberg terminal and see that current market yields to maturity for "zero coupon" (single-payment) bonds are as follows:

      7% for bonds paying off in March 2022 (one year zero-coupon bonds)
      8% for bonds paying off in March 2023 (two-year zero-coupon bonds)
      12% for bonds paying off March 2024 (three-year zero-coupon bonds)

a) 5 pts. Write a formula that shows the highest price anyone should be willing to pay for this bond. *Plug in actual numbers wherever you can* but do not try to solve the formula to get a number for the price.

b) 5 pts. Now suppose that today's market value of the bond is $300. Write a formula that defines the coupon bond's yield to maturity. Again, use all the information I gave you, plug in numbers where you can, but do not try to solve the formula. **Point out which symbol in the formula stands for the yield to maturity.**

c) 5 pts. Suppose that today's market price for the bond, $300, is less than the value that comes out of the formula you wrote down for part a) of this question. What could you do to make a lot of money very fast?

3) Draw what the yield curve would look like in each case below. With a dotted line, draw what the yield curve would look like if the expectations hypothesis were correct. With a solid line, draw the actual yield curve.
a) 5 pts. Everyone thinks future overnight rates may be
the same as today's, or higher, or lower - all
possibilities about equally likely.

b) 5 pts. Everyone thinks future overnight rates may
be the same as today's, or higher.

c) 5 pts. Everyone thinks future overnight rates may be
the same as today's, or lower.

4) 10 pts. Suppose that the assumption we make for the "expectations hypothesis" of the yield curve is correct, that is, all that people care about is the expected value of the return to their investments. Consider a five-year bond that can be bought today, in March 2021 and sold next year in March 2022. There is a 50% (1/2) probability that the price of the bond in March 2022 will be $1000. There is a 50% (1/2) probability that the price of the bond in March 2022 will be $800. What is the price of the bond today if today's yield on one-year Treasury bonds is 200%?

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5) 10 pts. The yield on a five-year bond issued by the General Electric Corporation is very likely to be lower than the interest rate on a five-year loan to the same corporation. This is generally true: the yield on a bond issued by a corporation is likely to be lower than the interest rate on a loans to the same corporation, of the same maturity. Why?

6) 15 pts. Suppose the "expectations hypothesis" of the yield curve is correct (there are no term premiums). Today, the overnight rate is 1%. People are sure it will remain 1% for a whole year.
After that, they believe, there are just two things that can happen.
With a probability of 1/2, the Fed will keep the overnight rate at 1% for several more years.
With a probability of 1/2, the Fed will raise the overnight rate to 3 percent, hold it at 3% for a year, then raise the overnight rate again to 5% and hold it at 5% for several years. On the graph below, plot today's yield curve. Be precise. Exact numbers matter. Show your work.

7) 10 pts. A company that issues a bond will pay a bond-rating company (e.g. Moody's or Standard & Poor's) to rate the bond, even if the bond is sure to get a low rating (e.g. BBB or CCC). Why?

8) 10 pts. Bond A and bond B are both multiple-payment bonds with a maturity of ten years – that is, each bond's last payment will be made ten years from now. Bond A is a *coupon* bond. Bond B is a *fixed-payment bond*. Today the market price of bond A is the same as the market price of bond B. If yields rise unexpectedly tomorrow, which bond's price will fall more, or will the two prices fall by the same amount? Explain.