No calculators. Total points on exam: 190. Good luck! Look over the entire exam before you begin. If I ask you to explain your answer, your grade for the question will depend on your *explanation*.

1) Consider a zero-coupon bond that you buy today, in May 2019, for a price P_t. The bond will pay $1000 thirty years from today, in May 2049 (maturity $n=30$). Ten years from today, in May 2029, you sell the bond for a price P_{t+10}.

a) 5 pts Write down a formula (do not solve) that defines the bond's yield in May 2019.

b) 5 pts Write down (do not solve) a formula that defines the bond's yield in May 2029.

c) 5 pts Write down (do not solve) a formula that defines the rate of return you receive from buying the bond in 2019 and selling it in 2029.

2) Consider a two-year coupon bond that you can buy today in May 2019. The bond will make coupon payments in May 2020 and May 2021, and also pay off its face value (par value) in May 2021. The face value is $36. The coupon rate, expressed as a fraction, is 1/3 (as a percent that's 33.3333333....) You look on a website and see that current yields to maturity on "zero coupon" bonds are:

         200% for bonds paying off in May 2020
         100% for bonds paying off in May 2121

a) 5 pts Calculate the highest price anyone should be willing to pay for this bond. I am looking for an actual dollar value. You can do it!

b) 5 pts. Using the price you calculated in a) and as many actual numbers as possible, write down (do not solve) a formula that defines the bond's yield to maturity. Point out which symbol stands for yield to maturity.

4) 10 pts. Suppose the Fed follows a "Taylor rule" in setting the target overnight rate. The target inflation rate is 3 percent. The natural rate of unemployment (also called the NAIRU) is 5 percent. I am going to ask you to tell me the exact, numerical formula for the Taylor rule based on the following information.
- When inflation is equal to three percent and the unemployment rate is equal to 5 percent, the Fed sets the overnight rate target equal to 1 percent.
- When inflation is equal to three percent and the unemployment rate is equal to 6 percent, the Fed sets the overnight rate target equal to 1/2 percent.
- When the unemployment rate is equal to 5 percent and the inflation rate is 4 percent, the Fed sets the overnight rate target equal to 3 percent.
What is the exact, numerical formula for the Taylor rule? I mean I want specific numbers wherever possible.

5) 10 pts. In the context of lending by a financial intermediary, explain the difference between "screening" and "monitoring + restrictive covenants."

6) Consider an economy with no banks and no central bank. A person faces a situation similar to that described by the standard Baumol-Tobin model. As in that model,

Y is annual income, received at the beginning of the year

i is the annual interest rate or bond yield (expressed as a fraction, as in class)

N is the number of financial transactions the person engages in.

$(M/P)^D = \dfrac{Y}{2N}$ is the average money balance if the person engages in N financial transactions.

Here, however, the cost of financial transactions is different from the standard Baumol-Tobin model. A person must pay her broker a fixed annual fee equal to Z, plus an additional cost per financial transaction equal to F per transaction. Thus, if a person engaged in 5 financial transactions, the fixed part of the fee would be Z and the additional cost would be $F \times 5$. If a person engaged in 10 financial transactions, the fixed part of the fee would still be Z and the additional cost would be $F \times 10$.

a) 10 pts Derive the average real money balance that a person will choose to hold.

b) 5 pts In this model, what is the effect on the economy's market interest rate or bond yield if the supply of real money balances remains fixed, but there is an increase in Z? Explain.

7) 10 pts. Theodora borrowed $100 from Tyler, and another $100 from Ann. Theodora promised to pay each lender (Tyler and Ann) an interest rate i. With the $200, Theodora bought an illiquid bond.
- If Tyler and Ann roll over (do not withdraw) their loans to Theodora, Theodora will pay them the interest rate she promised (with the money she gets from the bond's coupon payments).
- If both Tyler and Ann withdraw their loans to Theodora, Theodora will sell the bond as quickly as possible for a low price, just $120, and divide the $120 evenly between Tyler and Ann (each will get $60).
- If one lender withdraws and the other rolls over, the bond will be sold as quickly as possible for the price of $120, and the $120 will be divided evenly between Tyler and Ann, but there will *also* be a difficult case in bankruptcy court. The case will cost *both* lenders - Tyler and Ann - $5 in lawyers' fees ($5 each).
Fill in the boxes
to describe this situation.
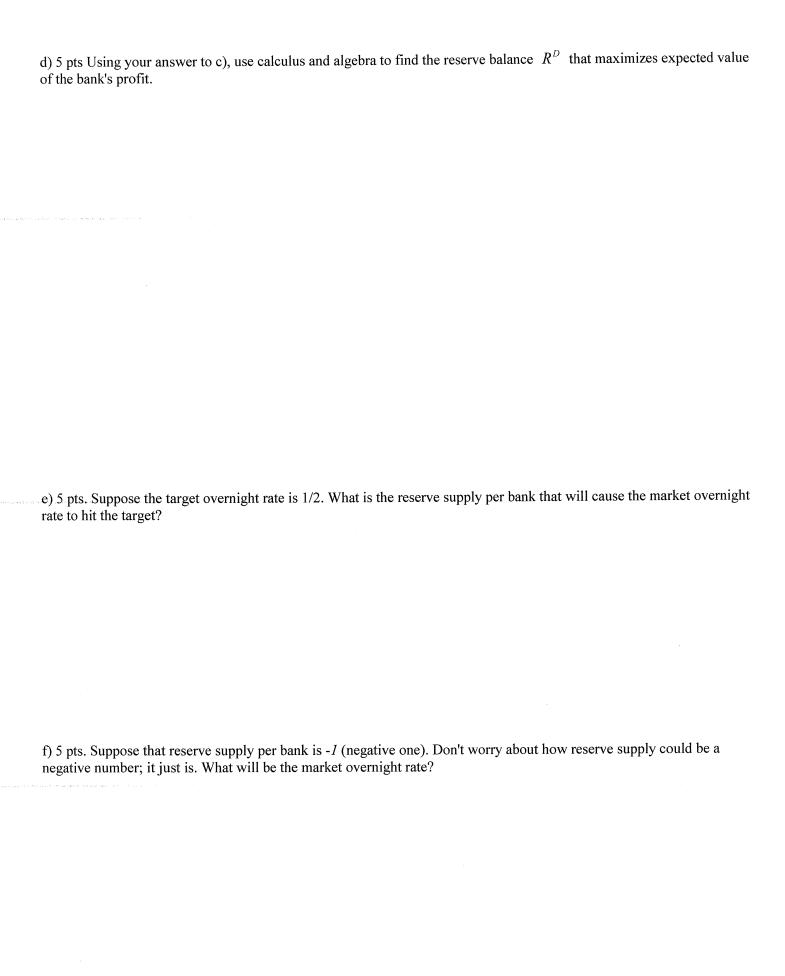CIRCLE the boxes that
are equilibria.

8) 10 pts. Suppose that the midday temperature in Binghamton is uniformly distributed between zero and 80 degrees. If tomorrow's temperature is 40 degrees or hotter, I will pay you $1 for every degree of temperature. (E.g., if the temperature is 55 degrees, I will pay you $55.) What is the expected value of the amount of money I will pay you tomorrow?
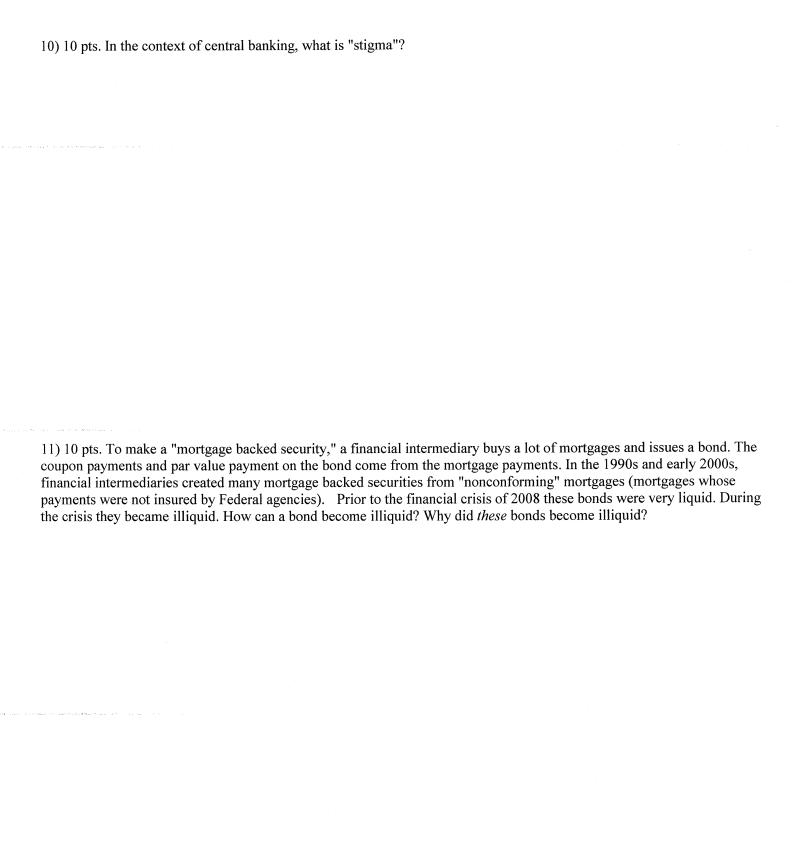
9) Suppose the Fed does *not* pay interest on reserves, but there *are* reserve requirements. All banks in the country are identical. Each bank has the same reserve requirement, equal to *1* (one). Each bank has *$100* to divide between its reserve account and overnight lending. At 5 pm each bank will choose how much to leave in its reserve account.Between 5 and 6 pm. the Fed will clear payments between banks, adding a net sum P to each bank's reserve account. P can be a positive or negative number. That leaves $R+P$ in the bank's reserve account at 6 pm. A bank will have a *reserve shortfall* if the balance after clearing, at 6 pm, falls below (or is just equal to) the reserve requirement of *1*. A bank with a reserve shortfall must take an emergency loan from the Fed to bring the balance up to the required level. The Fed charges an interest rate r_p for such emergency loans. This interest rate is equal to *2*. From a bank's point of view, P is a random variable, uniformly distributed between a minimum value (the smallest possible net payment into the bank's reserve account) of *-1*, and a maximum value (the largest possible payment into the bank's reserve account) of *+1*. The market overnight rate is denoted r.

a) 5 pts Using the information given above, write an expression that gives the probability that a bank will have a reserve shortfall, for any given value of R., assuming r is greater than zero but less than 2.

b) 5 pts *Assuming* a bank has a reserve shortfall, what is the expected value of the amount that the bank will have to borrow from the Fed, for any given value of R?

c) 5 pts Using your answers to a) and b), write an expression that gives the expected value of the bank's profit. Remember $r_p = 2$.

d) 5 pts Using your answer to c), use calculus and algebra to find the reserve balance R^D that maximizes expected value of the bank's profit.

e) 5 pts. Suppose the target overnight rate is 1/2. What is the reserve supply per bank that will cause the market overnight rate to hit the target?

f) 5 pts. Suppose that reserve supply per bank is -1 (negative one). Don't worry about how reserve supply could be a negative number; it just is. What will be the market overnight rate?

10) 10 pts. In the context of central banking, what is "stigma"?

11) 10 pts. To make a "mortgage backed security," a financial intermediary buys a lot of mortgages and issues a bond. The coupon payments and par value payment on the bond come from the mortgage payments. In the 1990s and early 2000s, financial intermediaries created many mortgage backed securities from "nonconforming" mortgages (mortgages whose payments were not insured by Federal agencies). Prior to the financial crisis of 2008 these bonds were very liquid. During the crisis they became illiquid. How can a bond become illiquid? Why did *these* bonds become illiquid?

12) 15 pts. Suppose the Fed follows an "inflation targeting" strategy. The overnight rate is well above the "zero bound" (don't worry about the zero bound problem). The Fed's target inflation rate is 2 percent. For simplicity, assume that the real interest rate that matters for the IS curve is simply the overnight rate minus expected future inflation. For all cases below, assume everyone believes that, in the future, the IS curve may remain stable, or shift back a little, or shift out a little - all possibilities equally likely. For each case, using a dotted line, draw what the "expectations hypothesis" yield curve will look like. Using a solid line, draw what the actual yield curve looks like (given the existence of term premiums).

a) The public's inflation expectations are "anchored," so that expected future inflation is equal to 2 percent.

b) The public's inflation expectations are "adaptive." Last year, inflation was one percent.

c) What is likely to happen to the yield curve if the public's inflation expectations are anchored as in a), but people suddenly become more uncertain about the future position of the IS curve. That is, they suddenly come to think that in the future the IS curve may remain stable, or shift back a *lot*, or shift out a *lot*. Explain your answer.

14) 15 pts. Your little brother Aloysius comes to Binghamton as a freshman. Like many little brothers he is annoying and overly sceptical. On your advice he starts out as an economics major and takes introductory macro (Econ 162). At the end of the semester he tells you that it is obviously nonsense. "The professor told me that there is an IS curve, so that an increase in the real interest rate makes real GDP fall and the unemployment rate go up. But I know that the Fed has been raising nominal interest rates over the last three years. Surveys show that expected future inflation has been two percent through all that time, so real interest rates must have been increasing. But real GDP has not fallen and the unemployment rate has not gone up. This IS curve business is for the birds. My professor is a big liar." Aloysius is wrong, of course. Explain why Aloysius is wrong.