Instructions. You have 3 hours to complete the exam. There are a total of 90 points available. It is designed to take about 1 minute per point. You are allowed to reference a single page of notes, 2-sided. You may use a calculator, if you like, but only to do simple calculations; you may not use any symbolic or graphing capabilities which your calculator may have. There is space provided for each question. If you need additional space, you may write on the back of the pages or use additional sheets and staple them to your exam when you turn it in. Please show all of your work. (Or at least enough so that the grader can figure out how you arrived at your answers.) Please write your name on the exam itself.

Name:________________________
1. (a) (5 points) Suppose the Frank has exactly $12 to spend on beer and pizza. Pizza is $1 per slice. Beer is priced at $2 per bottle for the first 4 bottles. Once someone has bought their first 4 bottles, they become members of the Oktoberfest Club and then it's just $0.50 per bottle. For example, if you buy 3 bottles the total cost would be $6, but if you buy 6 bottles, the total cost would be $9, $8 for the first four plus $1 each for bottles 5 and 6. Carefully draw a diagram showing Frank's budget set for combinations of beer and pizza. (You may assume that buying fractions of a bottle is possible). Be sure to label intercepts as well as marginal rates of transformation along each segment of the budget line.

(b) (5 points) Using one of the utility function types we have studied the most (Perfect Substitutes, Perfect Complements, and Cobb-Douglas), write down an exact specification of Frank's utility which would be consistent with the observation that he demands exactly 4 beers.
(c) (5 points) Suppose that Franks’s preferences are Cobb-Douglas:
\[ u(b, z) = b^\alpha z^{(1-\alpha)} \]
Is it possible that for some choice of \( \alpha \) between 0 and 1, Frank’s demand for beer could be 4 bottles? Explain why or why not. [Hint: In your answer you may want to describe the relationship between MRS and MRT to the right along the budget line and to the left along the budget line.]
2. (a) (5 points) Draw a diagram with today’s consumption on the horizontal axis and tomorrow’s consumption on the vertical axis. Depict in this diagram the budget set for someone who will earn $400 today and $1100 tomorrow who faces a one-period interest rate of .10. Be sure to carefully label the intercepts.

(b) (5 points) In the same diagram show the preferences for some who would borrow $200 today. Be sure to label their consumption today and tomorrow. [You may leave the numbers in expression form.]
(c) (10 points) Use a new diagram to explain the change on *today’s consumption* of an interest rate decrease from $r'$ to $r$ for someone who would have been a saver under the higher interest rate, $r'$. In particular, your graph should show the decomposition of the change in today’s consumption into income and substitution effects. Assume that today’s consumptions and tomorrow’s consumption are *normal* goods.
3. Present Value

(a) (10 points) Your friend Mandy wants you to invest in her new bakery. She promises that every dollar you invest will return $.40 per year for 3 years, starting in one year. If you don’t invest in her bakery you will save your money in a savings account which pays interest at an annual rate, \( r \). Write down an expression involving \( r \) that tells you the present value of a $1000 investment in Mandy’s bakery. Explain how you would use it to make your decision of whether to invest the thousand or not.

(b) (5 points) If the interest rate is .05, what is value of an apartment which costs $1000 per year to maintain and generates $11,000 per year in rental revenue? [You may leave you answer in expression form for full credit.]
4. Avery is risk averse. [Note you should draw one diagram for this entire problem]
   (a) (5 points) Draw a picture of Avery’s utility over wealth outcomes. Put wealth on the horizontal axis and utility on the vertical axis.
   (b) (5 Points) There is a 50% of rain. Avery has $500 in a savings account. He also owns a house. If it rains Avery’s house will flood and become worthless. If it does not rain, Avery’s house is worth $1000. In your picture mark the level of wealth Avery will have in both states of nature as well as Avery’s expected wealth.
   (c) (5 Points) Using the graphical method we discussed in class, label on the vertical axis, Avery’s expected utility.
   (d) (5 Points) Label the amount of certain wealth Avery would be willing to take in exchange for both his house and his savings account.
   (e) (5 Points) By identifying a segment of the horizontal axis, label the minimum price Avery would ask for his house.
5. John likes to go out in his canoe to get in a little fishing and enjoy the peace. Ralph likes to go water-skiing in the same lake. Ralph’s willingness to pay for the first hour of water-skiing per day is extremely high, but decreases for each hour after that. In other words Ralph has decreasing MWTP for waterskiing. Also assume that his MWTP does not reach zero until the 11th hour of waterskiing.

Ralph doesn’t really mind John’s presence out on the lake. Having to steer a course around his canoe, makes the water-skiing that much more fun. John, on the other hand, often wonders just how quickly he would reach for his cell phone if he noticed that Ralph were drowning. In fact, the more time Ralph spends out on the lake, the more it bothers John and it bothers him at an increasing rate. This increasing marginal damage function starts out very low, but by the 11th hour of Ralph’s skiing, it is extremely high.

(a) (5 Points) Describe the efficient solution using a diagram with the number of hours Ralph spends waterskiing on the horizontal axis.
(b) (5 Points) Describe how the efficient solution might be reached as an equilibrium using a tax on water-skiing.
(c) (5 Points) Label the welfare effects of the tax (Ralph’s surplus changes, John’s surplus changes, Government Revenue) compared to the case where Ralph skis all that wants.