Instructions. You have 3 hours to complete the exam. There are 6 questions worth 80 points, but you will be graded out of 70 points. You should skip over exactly one of the questions marked “skippable”. The grader will ignore the question you skip. It is designed to take about 1 minute per point.

You are allowed to reference a single page of notes, 2-sided. You may not use any other notes, books or aids of any kind, be they human, electronic or mechanical. Calculations, if called for, may be left in expression form for full credit. 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 your work and explain or justify your answers where needed. Please write your name on the exam itself and record the time you started and time you finished. (This is for my records only and has no bearing on your grade.) Finally, please turn in your cheat sheet with your exam. Thank you and good luck!
(1) [10 Points, skippable] Antonio who has very good credit with local lending institutions has two friends, Bassanio and Salarino who are not in good financial standing. They come to him with two investment proposals. After reading over each proposal Antonio tells Bassanio, “I will happily invest in your venture if I can borrow money at no more than 8% annual interest.” He tells Salarino, “I will happily back your venture when I am able to lend money at no less than 8%”. Speculate on the difference between Bassanio’s and Salarino’s projects and explain.
(2) [10 Points, skippable] Executives at the Zerk pharmaceutical company started planning for a new drug, *Popsquil*, in 1995. At that time, they announced to their board that, by their best estimates of market demand for *Popsquil* and the expected research costs, they expected the present value of profit on the entire project to be $5 million. The board, upon hearing this in 1995, enthusiastically approved the project. Ten years later, in 2005, *Popsquil* was ready to enter clinical trials. The executives made another presentation to the board at this time telling them that they now expected the 1995 present value of the entire project to be -$5 million. That is, *negative* five million dollars. The board again enthusiastically approved the project to move forward and go to the clinical trial stage. Many shareholders upon hearing of the board approval are dumbfounded and demand to know why Zerk is pursuing a losing venture. Assuming the board is rational and seeks to maximize profit and that the executives have done honest objective analysis both in 1995 and in 2005. Explain the board’s decision to these doubting shareholders and speculate on what changed or was learned between 1995 and 2005 which could account for the difference in the executives’ profit estimates.
(3) [20 Points] Suppose that the city council in Lexington decides to pass a “living wage” law which specifies that all employees working in the city of must be paid $10 per hour. Meanwhile jobs in the surrounding county are subject only to the federal minimum wage law of $4 per hour. Make the following assumptions where needed.

- Assume that before the passage of the “living wage” law, the market-clearing wage throughout the entire region (city and county) was $7 per hour.
- Assume that this a perfectly homogeneous labor market in the sense that all employees and all the hours they work are perfect substitutes from employers’ point of view.
- Assume that workers are mobile, easily able to shift from jobs in the city to the county and vice versa. Employers and jobs are not mobile.

(a) [10 points] Using a diagram which includes supply, county demand, and aggregate demand, explain what effect the new law will have on wages and employment both in the city and in the surrounding county. Put the prevailing wage in the county on the vertical axis of your diagram.

(b) [10 points, skippable] Assume that only workers who would have worked before the law change are working after the law change. Assume further that those employees work the same or fewer number of hours. Identify on your diagram areas representing the net employee surplus change due to the law change. Are workers better off? Explain.
(4) [10 points, skippable] George mines for gold using labor (L) capital (K) and mercury (H) which is used to separate the gold from the ore. The production function is

\[ f(L, K, H) = L^{\frac{1}{5}} K^{\frac{2}{5}} H^{\frac{1}{5}} \]

(a) Is the return to scale for George’s mining operation decreasing, increasing or constant? Show your work and explain your answer.

(b) Most of the mercury used to extract the gold is recovered for re-use. If it were all recovered George would not need any Mercury beyond his initial investment. The more time and effort he spends to carefully recover the mercury, the less he needs to produce the same amount of gold. What is the marginal rate of technical substitution of labor for mercury? Interpret your answer by putting it into a sentence.

(c) Suppose that George’s mining operation is solving the full profit maximization problem and currently uses 100 hours of labor per week at $5 per hour. Suppose that mercury costs $500 per unit\(^1\). What is George’s demand for Mercury? Be sure to show your work and explain your reasoning.

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\(^1\)Bulk Mercury is typically sold in “flasks” each containing 76 lbs. $250-$600 per flask is a typical range of prices lately.
(5) [20 points] Mercury-runoff from gold-mining operations is thought to contribute significantly to mercury levels in the Amazon and its tributaries. This is bad for the local fishing industry as their catch becomes significantly less marketable. Suppose that demand for mercury among gold-miners in the Amazon is given by the following marginal willingness to pay schedule.

\[ MWTP = 2000 - q \]

while the cost to the fishing industry of mercury in the rivers is given by the following marginal cost function

\[ MC = \frac{1}{2}q \]

where \( q \) is the quantity of mercury measured in ‘flasks’ and MWTP and MC are both measured in $/per flask. Assume that every flask demanded by gold miners eventually ends up in the river and that gold-mining is the only source of mercury pollution. Assume also that, from the gold-miner’s point of view, the supply of mercury is perfectly elastic at $500 / flask. Draw a diagram showing the demand, marginal private cost and marginal social cost of mercury in the Amazon. Indicate the following quantities on your diagram. (Calculations are not required.)

(a) Quantity demanded for Mercury without any regulation, \( Q_D^0 \)
(b) The size of an efficient Mercury tax, \( \tau_{eff} \)
(c) Demand for Mercury with the efficient tax, \( Q_D^1 \)
(d) Government revenue from an efficient tax.
(e) Savings to the fishing industry from an efficient tax.
(6) [10 Points, skippable] The Q&Q candy company makes two sizes of packages of its Q&Q candies, a small “snack size” and a large “king size”. Felix, a new marketing executive at Q&Q suggests that Q&Q could increase its profit if it made its “snack size” even smaller. Using a diagram, explain why he might be right.