FULL NAME ____________________________________

ID NUMBER ____________________________________

SIGNATURE ____________________________________

FINAL EXAM

Instructions

- This exam's contribution to your final grade is 40%.
- There are six questions in this exam. You should answer two of these questions.
- Mobile phones and laptop computers should be turned off.
- You are not allowed to leave the room for the first 30 minutes of the exam time.
- This is a closed-books and closed-notes exam.
- You are not allowed to talk to each other during the exam.
- *Student Discipline Regulations of the Institutions of Higher Education* are in effect. According to the 9th article, cheating in this exam may have severe consequences for you—including a temporary suspension of your studies up to two semesters.
- You have exactly 80 minutes to complete the exam.

Questions

(*Answer only two of the questions.*)

Question 1. [20 points] The Market Equilibrium.
A model of a market is as follows:

$$\begin{aligned} Q^d &= \alpha \\ Q^s &= s(P,X) \\ Q^d - Q^s &= f(P) \end{aligned}$$

Here, Q^d denotes the quantity demanded, Q^s denotes the quantity supplied, P denotes the price level, and X is a measure of technology. The endogenous variables are Q^d, Q^s and P. $\alpha > 0$ is a fixed parameter, $s(P,X)$ is a C^1 function that is strictly increasing in both P and X, and $f(P)$ is a C^1 function satisfying

$$f(\theta) = 0 \quad and \quad f'(P) < 0$$

where $\theta > 0$ is a fixed parameter. Using this model, the purpose is to understand equilibrium in its usual sense. Explain why it is assumed that $f(\theta) = 0$ and that $f'(P) < 0$.

Question 2. [20 points] Cost Minimization vs. Profit Maximization.
A perfectly competitive firm, which employs only capital k and labor ℓ, is constrained with

$$f(k,\ell) = y^\star$$

where $f(\bullet,\bullet)$ is its production function and $y^\star > 0$ is its exogenously given production target. Define the firm's cost function $c(k,\ell)$ and profit function $\pi(k,\ell)$ with an exogenous output price p and exogenous input prices (w_k, w_ℓ), and show that cost minimization is identical to profit maximization for this firm (*Hint*: You do not need to solve these minimization and maximization problems. Just recall that a maximization problem can be written as a minimization problem!).

Question 3. [20 points] If you're gonna be poorer tomorrow, you should save more today.
A consumer/saver has the utility function

$$U(c_1, c_2) \equiv \ln(c_1) + 0.95 \ln(c_2)$$

where subscripts 1 and 2 respectively denote today and tomorrow, and c is the level of consumption. The consumer/saver has an income of $y_1 = 1000$ today, and her exogenous income tomorrow is denoted by $y_2 > 0$. The budget constraints read

$$c_1 + s = 1000 \qquad \text{and} \qquad c_2 = (1.10)s + y_2$$

where s denotes saving. Show that

$$\frac{\partial s^\star}{\partial y_2} < 0$$

where $s^\star$ is the utility-maximizing level of saving (*Hint*: Work with an interior solution, and do not check the S.O.S.C.s).

Question 4. **[20 points] Oil Shocks and the Monetary Policy.**
Many economists believe that expansionary demand policies would lead to higher inflation during recessions if the economy has been hit by a negative supply shock. To understand this, a linear demand-and-supply model of an economy in the short run is specified by

$$y^d = \alpha(m - p) \qquad y^s = \beta p - \gamma p^{\text{oil}} \qquad \text{and} \qquad y^d = y^s = y^\star$$

where y^d is the aggregate demand, y^s is the aggregate supply, $y^\star$ is the equilibrium level of output, p is the aggregate price level, $m > 0$ is the (exogenous) supply of money, and $p^{\text{oil}} > 0$ is the (exogenous) world price of crude oil. The fixed parameters are such that $\alpha, \beta, \gamma > 0$. Suppose that the economy is initially in equilibrium. A sudden increase in p^{oil} causes firms to decrease their scale; $y^\star$ decreases and $p^\star$ increases. *Mathematically* show that, if the government uses expansionary monetary policy ($\Delta m > 0$) to increase $y^\star$ back to its initial level, the economy has to face an even higher level of $p^\star$.

Question 5. **[20 points] "Jeopardy!"**
Edmond Dantès has initially 100 dollars. His utility from money is defined by

$$u(m) = 2\sqrt{m}$$

In the casino, there is a (fair) coin toss game that pays five times the invested money with probability 50% and pays nothing otherwise. For example, if Edmond Dantès puts x dollars to the game, he either gets $5x$ dollars back ($4x$ net) or loses the amount x that he has invested. Your task, as you may have guessed, is to find the optimal amount $x^\star$ of invested money under the assumption that Edmond Dantès is *an expected utility maximizer* (*Hint*: Work with an interior solution, and do not check the S.O.S.C.s).

Question 6. **[20 points] The Effect of Non-Wage Income on Leisure.**
Write down a simple consumption-leisure model of an individual, solve the model, and analyze the effect of non-wage income—exogenous income that does not depend on leisure—on optimal choice of leisure.