1. (10%) A firm uses 2 inputs to produce 1 output. The production function is $f(x_1, x_2) = \max\{x_1, x_2\}$.

   (a) Calculate the cost-minimizing factor demands to produce 1 unit of output when the vector of factor prices is $(w_1, w_2) = (1,1)$. (2%)

   (b) Another firm uses 4 inputs to produce 1 output. The production function is $f(x_1, x_2, x_3, x_4) = \min\{x_1, 2x_2\} + \min\{2x_3, x_4\}$. Calculate the cost-minimizing factor demands to produce 1 unit of output when the vector of factor prices is $(w_1, w_2, w_3, w_4) = (1,2,3,4)$. (4%)

   (c) A third firm also uses 4 inputs to produce 1 output. The production function is $f(x_1, x_2, x_3, x_4) = \min\{x_1 + 2x_2, 2x_3 + x_4\}$. Calculate the cost-minimizing factor demands to produce 1 unit of output when the vector of factor prices is $(w_1, w_2, w_3, w_4) = (1,2,3,4)$. (4%)

2. (10%) Ayako is an economist currently lives and works in (Washington) D.C. The job pays her $150, and Ayako has no other income. Her utility function is $u(x, y) = \min\{x, y\}$, where $x$ and $y$ are two goods that she consumes. Let $(p_x, p_y) = (1,1)$. Ayako's boss is asking her to move to New York where $(p_x, p_y) = (1,2)$. There is no change in the salary. Ayako is very angry so she went to talk to her boss: "Although I do not mind moving to New York, but this move is as bad as a cut in the salary of $A in D.C. I wouldn't mind moving to New York if I receive a raise of at least $B." What are A and B? (5%, 5%)

3. (10%) Fish farmers culture a certain kind of fish using land and labor. The labor cost in dollars to produce $y$ tons of fish is $c(y) = y^2$. There are 100 identical fish farms which all behave competitively.

   (a) What is the individual fish farmer's supply curve of fish $y(p)$? (3%)

   (b) What is the market supply of fish $Y(p)$? (2%)

   (c) Suppose the demand curve of fish is $D(p) = 200 - 50p$. What is the equilibrium price and quantity sold?

(2%)

(d) What is the equilibrium rent on the land? (3%)

4. (10%) Two teenagers (Players A and B) decided to settle a dispute through playing Chicken. They would drive their cars towards each other at maximum speed on a one-lane road. Each has two strategies: <u>stay on the road</u> or <u>swerve to the roadside</u>. If one player chooses to swerve to the roadside he loses face; if both swerve to the roadside, they both lose face. However, if both choose to stay on the road, they will both be killed in a head-on collision. The payoff matrix of this Chicken game is as follows:

|  |  | Player B | |
|---|---|---|---|
|  |  | Stay on the road | Swerve to the roadside |
| Player A | Stay on the road | -3,-3 | 2,0 |
|  | Swerve to the roadside | 0,2 | 1,1 |

(a) Find all pure strategy equilibria. (4%)

(b) Find all missed strategy equilibria. (3%)

(c) What is the probability that both teenagers will survive? (3%)

5. (10%) A restaurant that you often go in your neighborhood is for sale. Suppose the restaurant is currently making $x \geq 0$ dollars, and you are the only person who is seriously thinking about buying the restaurant. Since you are a more efficient manager, once taking over the restaurant, you will be able to make $\theta x$ dollars, where $\theta > 1$. You and the current owner would reach an agreement as long as (expected) profits are nonnegative.

(a) Suppose you know the exact amount of $x$. Maximizing profit, what is your total willingness to pay for the restaurant and why? (3%)

(b) Suppose the exact amount of $x$ is a private information of the current owner but you know it is drawn from uniform distribution with range [0,100]. Find out the parameter value $\theta$, below which you should never buy the restaurant. (7%)

(16%) 6. Consider the following set up:

a. Aggregate supply (AS) is perfectly flat;

b. Taxes are lump sum: T=70;

c. Consumption function: $C = 120 - P + 0.9*Y^D$; $Y^D$ is disposable income

d. Government expenditure: G = 70, Net Export: NX = 0;

e. Investment function: $I = 60 - 2.5*r$; r is the real interest rate,

f. Money supply is: M = 50;

g. Money demand is: $M = 100 - 5*r$;

Answer the following questions:

1) Suppose that the output gap (the difference between full employment and equilibrium output) is 100. The Central Bank's target is to make the gap equal to zero. Should the Central Bank increase or decrease the money supply? (5% ) By how much? (6%) Show your work.

2) Suppose now that aggregate supply is upward sloping. Its function is: P = 50+Y. Would the policy you found at 1) be enough to close the output gap? Explain. (5%)

(16%) 7. Imagine that the tax system in country A prescribes (規定) that no taxes are levied on income below $20,000 and a tax of 30% is levied on all the income above $20,000. The tax system in country B instead prescribes that no taxes are levied on income below $5,000 and a tax of 30% is levied on all the income above $5,000.

1) Imagine that Luca has an income of $25,000. What is the marginal tax rate and the average tax rate that he would face in country A and in country B? (4%) What happen to his labor supply if he moves from country A to country B? (4%)

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2) Now imagine that Marco lives in country B, but the tax system suddenly changes and no taxes are levied on income below \$20,000 and a tax of 32% is levied on all the income above \$20,000. At the same time Marco find a very good job and his income becomes \$80,000. What is the marginal tax rate and the average tax rate that he would face now in country B? (4%) How do these changes affect his labor supply? (4%)

(18%) 8. How would each of the following changes affect the <u>steady-state values of the capital-labor ratio</u>, <u>output per worker</u>, and <u>consumption per worker</u>?

1) A change in the composition of the capital stock raises the depreciation rate. (6%)
2) Government tax policies change to encourage a higher saving rate. (6%)
3) A supply shock reduces productivity sharply. (6%)