Микроэкономика 2 — МИЭФ, 2026 demo midterm

МИЭФ | Микроэкономика 2 | 2026 | demo midterm

Рисунки пока рендерятся в тестовом режиме и могут отличаться от исходных материалов.

PROBLEM 1

Willingness to pay for a vaccine — 10 points

An agent has wealth of \$10 and may contract COVID.

- Severe COVID causes a loss of \$6 and occurs with probability 0.25.
- Light COVID causes a loss of \$2 and occurs with probability 0.5.
- The agent remains healthy with probability 0.25.

The agent can purchase a new vaccine that reduces the probability of every type of COVID to zero.

His elementary utility function is

$$u(x) = x^2.$$

Find the maximum price that the agent is willing to pay for the vaccine.

Point allocation:

- expected utility without the vaccine — **3 points**;
- equation determining the maximum price — **4 points**;
- solution — **3 points**.

PROBLEM 2

Portfolio choice under uncertainty — 16 points

An agent allocates wealth

$$W = 200$$

between a bank deposit, asset 1, and bonds, asset 2.

Asset 1 is riskless: for each $1 invested, the agent receives the dollar back, so the net return is zero.

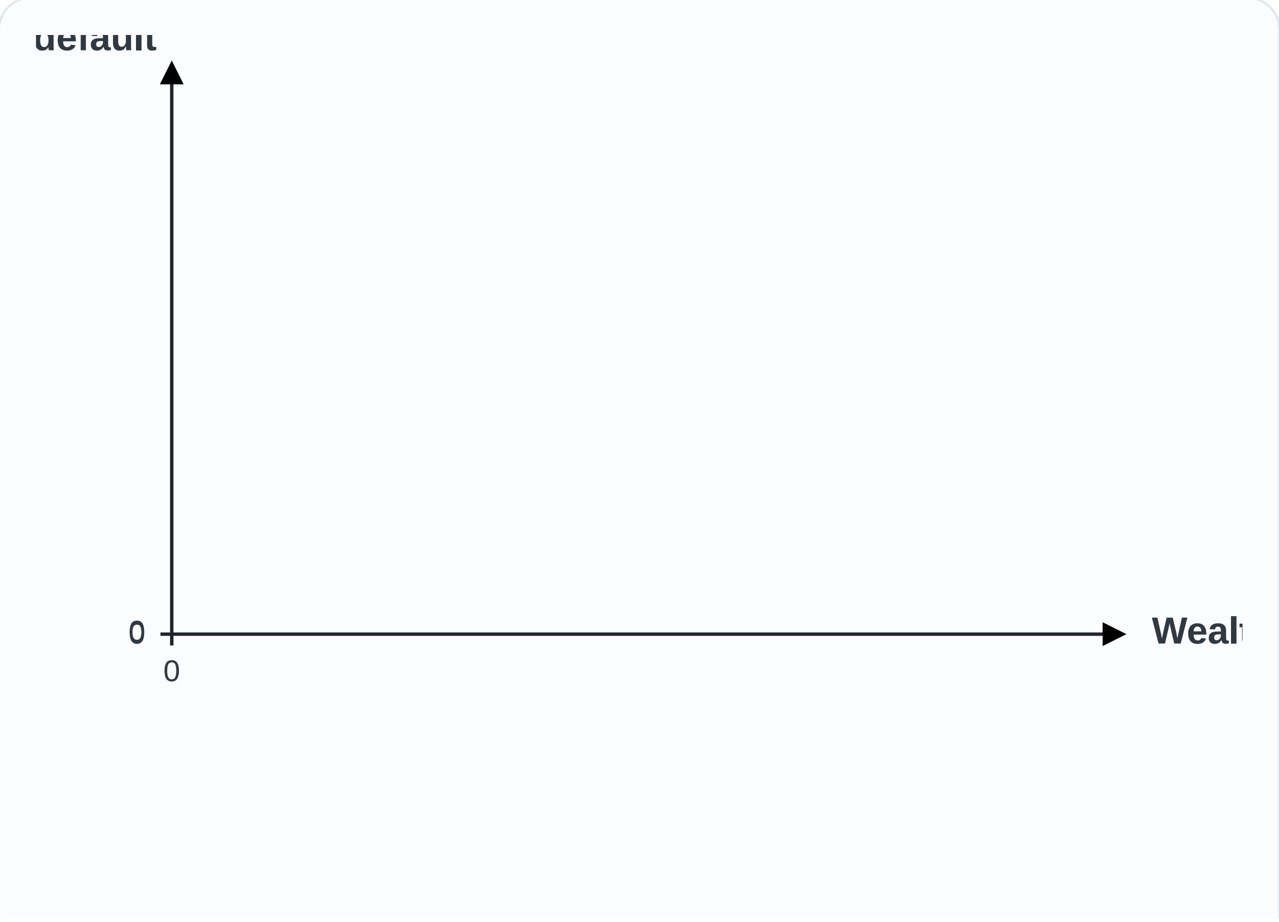
Bonds are risky because they default with probability

$$p, \qquad 0 < p < 1.$$

- If default occurs, the investor receives no money back.
- If no default occurs, every $1 invested in bonds gives a gross return of μ, where

$$\mu(1-p) > 1.$$

The budget line is the segment AB in the following state-contingent wealth diagram.



State-contingent wealth budget line for deposits and risky bonds

(i) (7 points) Label the graph by filling in the three boxes.

Find graphically the optimal portfolio of a risk-neutral agent, denote it by E, and explain the result.

Point allocation:

- correctly filled boxes — **2 points**;
- indifference curves and a comment on their slope — **2 points**;
- optimal portfolio, with graphical derivation — **1 point**;
- explanation of the result — **2 points**.

(ii) (9 points) Consider an investor with utility function

$$u(x) = -e^{-\alpha x}, \qquad \alpha > 0.$$

His initial optimal portfolio, denoted by D, is the midpoint of segment AB.

Suppose the investor's wealth increases by 50%.

Calculate the coefficient of absolute risk aversion and determine graphically how the portfolio changes as a result of the increase in wealth.

Denote the new portfolio by F. Both D and F must be shown on the diagram above.

Point allocation:

- coefficient of absolute risk aversion — **2 points**;
- implication of CARA preferences for demand for the risky asset — **2 points**;
- new budget line — **1 point**;
- point F and graphical explanation — **2 points**;
- new portfolio composition — **2 points**.

PROBLEM 3

Intertemporal choice — 35 points

Consider a two-period intertemporal-choice model.

An agent receives income Y_0 in the current period and Y_1 in the future period. He pays lump-sum taxes T_0 in the current period and T_1 in the future period.

The agent can borrow and lend at a real interest rate

$$r > 0.$$

His utility function is

$$u(c_0) + \beta u(c_1),$$

where

$$u' > 0, \qquad \beta > 0.$$

(a) (7 points) Write the present-value intertemporal budget constraint.

Can this constraint be non-binding at the optimum?

Point allocation:

- intertemporal budget constraint in present-value form — **3 points**;
- proof that it binds, or a valid argument to the contrary — **4 points**.

(b) (7 points) Suppose the agent is initially a net borrower.

The interest rate rises, and the government simultaneously adjusts lump-sum taxes so that the initial consumption bundle remains just affordable.

How are current consumption and welfare affected?

Provide a graph and an intuitive explanation.

(c) (7 points) Suppose the indirect utility function is

$$v(r, W(r)) = \frac{(W(r))^2}{4(1+r)},$$

where $W(r)$ is the present value of lifetime income.

Let

$$Y_0 = 20, \qquad Y_1 = 30, \qquad T_0 = T_1 = 0.$$

The interest rate rises from

$$0$$

to

$$0.44,$$

while taxes remain unchanged.

Find the compensating variation in present-value terms. A graph is not required.

(d) (14 points) Assume

$$u'' < 0.$$

The indirect utility function from part (c) should no longer be used.

1. Assuming an interior solution, determine whether c_0 is a normal good — **7 points**.
2. Determine how saving changes when the interest rate rises, and explain the result — **7 points**.

PROBLEM 4

Endowment economy and price changes — 15 points

For any two bundles

$$X = (x_1, x_2)$$

and

$$Y = (y_1, y_2),$$

preferences satisfy

$$X \succeq Y \quad \Longleftrightarrow \quad x_2 + x_2 x_1 \geq y_2 + y_2 y_1.$$

(a) (7 points) The consumer has an endowment of 6 units of each good.

The price of good 2 is 1, and the price of good 1 is p.

For what value of p is the consumer neither a net seller nor a net buyer of good 1?

Denote this value by

$$p^*.$$

(b) (8 points) Without calculations, determine whether the consumer necessarily benefits from both:

- an increase in the price of good 1 from p^* to any $p' > p^*$;
- a decrease in the price of good 1 from p^* to any $p'' < p^*$.

Explain carefully.

PROBLEM 5

Compensating and equivalent variation — 25 points

Dan spends his pension on food and clothing.

He moves from town A to town B. The price of clothing is unchanged, but food is more expensive in town B.

Dan's pension is higher in town B because the local authorities provide an additional payment.

Dan's income elasticity of demand for food is

$$IED_F = -0.3.$$

(a) (10 points) How do Dan's welfare and food consumption change if the additional payment equals the compensating variation?

Illustrate the answer graphically and provide an intuitive explanation.

Point allocation:

- change in food consumption and explanation using the Hicksian substitution effect and zero income effect — **3 points**;
- change in welfare based on the definition of compensating variation — **2 points**;
- graph clearly showing that food is inferior — **5 points**.

(b) (15 points) How does the answer to part (a) change if the additional payment equals the equivalent variation?

Point allocation:

- graph with compensated demand and comparison of EV and CV, including a conclusion — **8 points**;
- intuitive explanation of the change in food consumption — **1 point**;
- intuitive explanation of the welfare effect — **6 points**.

PROBLEM 6

Farming under uncertainty — 40 points

There is a 50% probability that the growing season will be abnormally rainy.

Farmer A must choose between corn and wheat, with the following net-income prospects:

Weather	Corn	Wheat
Rainy	6	4
Normal	6	8

(a) (10 points) If the two crops cannot be combined, which crop should farmer A choose if his utility of money is

$$u(m) = \ln(m)?$$

Solve algebraically and explain the result.

Point allocation:

- algebraic solution — **5 points**;
- explanation — **5 points**.

(b) (10 points) Farmer A can purchase a weather forecast that reveals with certainty whether the next season will be rainy.

Construct a decision tree and find the maximum amount he is willing to pay for the forecast.

Denote it by

$$X_A.$$

Point allocation:

- decision tree with the decisions clearly indicated — **5 points**;
- expected utility with information — **2 points**;
- indifference equation and solution for X_A — **3 points**.

(c) (10 points) Let X_B be the willingness to pay for the same forecast by a risk-neutral farmer B with the same net-income prospects as farmer A.

Compare X_A and X_B.

Is the result counterintuitive? Explain carefully.

Point allocation:

- derivation of X_B — **4 points**;
- comparison and explanation — **6 points**.

(d) (10 points) Farmer A may invest in both crops in any proportion.

Corn producers are taxed so that corn produces net income

$$6 - t$$

regardless of the weather, while wheat producers are not taxed.

For every

$$t \in [0, 2],$$

find the optimal combination of corn and wheat chosen by farmer A.

Set up the optimization problem and solve it using Kuhn-Tucker conditions.

Point allocation:

- expected-utility maximization problem — **3 points**;
- interior and two corner cases based on Kuhn-Tucker conditions — **7 points**.

PROBLEM 7

Strategic-form and sequential games — 40 points

Two players play the following simultaneous-move game:

Player 1 \ Player 2	L	M	H
A	$(5, z)$	$(3, 4)$	$(2, 2)$
B	$(2, 5)$	$(4, 6)$	$(3, 2)$
C	(y, x)	$(2, 3)$	$(5, 5)$

(a) (8 points) Let

$$z = 3.$$

Give a rigorous algebraic, rather than verbal, definition of a strictly dominated strategy.

Find all values of x and y for which at least one player has a strictly dominated strategy, or prove that there are no such values.

A strategy may be dominated by a mixed strategy, not only by a pure strategy.

Point allocation:

- definition — **2 points**;
- derivation of the parameter values — **6 points**.

(b) (8 points) Let

$$z = x = 4, \qquad y = 3.$$

Find every completely mixed-strategy Nash equilibrium, meaning every Nash equilibrium in which every pure strategy is played with positive probability, or prove that no such equilibrium exists.

Use an approach that generates only completely mixed equilibria. State the theoretical result or results used; proofs are not required.

Point allocation:

- theoretical claim — **1 point**;

- derivation of the completely mixed equilibrium or proof of non-existence — **7 points**.

(c) (24 points) Modify the game as follows.

1. Player 1 moves first and chooses whether to participate, $P1$, or stay out, $O1$.
2. Player 2 observes this choice and chooses whether to participate, $P2$, or stay out, $O2$.
3. A player who stays out receives payoff

$$\frac{9}{2}.$$

4. If exactly one player participates, that player receives payoff 6.
5. If both players participate, player 1 chooses between B and C.
6. Player 2 observes player 1's choice and responds with M or H.
7. The payoffs after both players participate are the corresponding payoffs in the matrix above.

(i) (3 points) Construct the game tree.

(ii) (5 points) Define a subgame and identify every subgame of the sequential game.

Point allocation:

- definition — **2 points**;
- list of subgames — **3 points**.

(iii) (9 points) Define SPNE and find every pure- and mixed-strategy SPNE. Give a complete list.

Point allocation:

- definition — **1 point**;
- pure-strategy SPNE — **5 points**;
- mixed-strategy SPNE — **3 points**.

A complete strategy must specify an action at every decision node belonging to the player.

In this game:

- player 1 has two decision nodes;
- player 2 has four decision nodes.

Any proposed SPNE or Nash equilibrium must therefore specify two choices for player 1 and four choices for player 2.

(iv) (7 points) Find a pure-strategy Nash equilibrium that is not subgame perfect and justify the answer, or prove that no such equilibrium exists.

A normal-form representation is not required.