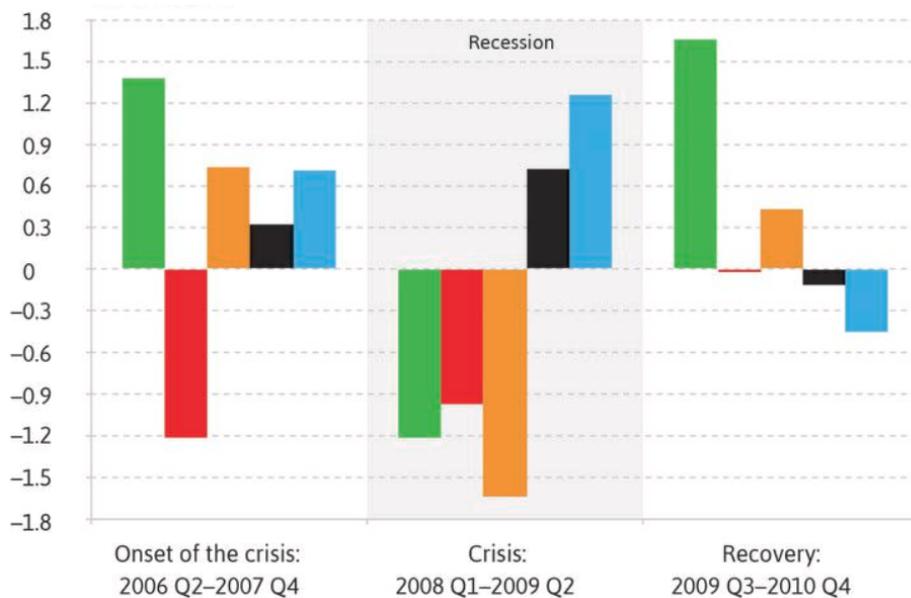## Multiple Choice Questions

1) Investor J is convinced that there is a price bubble on the market and that it will burst in the future after the price rises a little more. If he acts in accordance with this belief, which of the following is true?
   a) J will buy this asset and wait until the price falls to sell it
   b) J will short sell this asset and wait until the price drops to buy it, gaining risk-free profit
   c) J will short sell this asset and wait until the price drops to buy it, taking into account the importance of timing
   d) J will remain inactive since bubbles are risky and could lead to significant losses, unlike other assets

2) Think about the Lorenz curve constructed by lining up all the individuals in the world from lowest to highest income, irrespective of the country people live in. What is the closest estimate of the Gini coefficient of this curve?
   a) 0.1   b) 0.2   c) 0.3   d) 0.7

3) Which of the following scholars is most famous for using field experiments in their research?
   a) Eric Maskin   b) Esther Duflo
   c) Eugene Fama   d) Gregory Mankiw

4) The market for widgets in country A is perfectly competitive; D = 100 – 20P is the demand function, the supply function is given by S = 20P – 20. The world price for widgets is 2. Choose the correct statement:
   a) The autarky price of widgets is 4
   b) Under free trade, country A is an exporter of widgets
   c) If the government introduces an import tariff t = 2, there is no trade
   d) If the government introduces an import tariff t = 2, domestic consumers are better off compared to free trade

5) When investors buy a share to cover their short positions, which results in a rapid increase in this share price, this is called...
   a) Short squeeze
   b) Game stop
   c) Long squeeze
   d) Fundamental shock

6) Economist N calculates income inequality based on the Gini coefficient and the incomes of all <u>individuals</u> in the society. Economist M calculates income inequality based on the Gini coefficient and the incomes of all <u>families</u> in the society (simply adds up all family members' incomes before constructing the Lorenz curve). Which of the following is true?
    a) N's Gini coefficient is likely to be smaller than M's
    b) M's Gini coefficient is likely to be smaller than N's
    c) The two Gini coefficients will be the same
    d) None of the other statements is true

7) Which of the following statements best describes the Efficient Market Hypothesis?
    a) Share prices on the market reflect all available information
    b) Stock markets produce no externalities
    c) Government interventions can make markets more efficient
    d) Natural monopolies should not be regulated

8) Which of the following letters is not used to describe the type of recession (and recovery)?
    a) U   b) V   c) L   d) T

9) In this diagram, you can see the contribution of different components of the aggregate demand to the U.S. GDP change during the global financial crisis (in annual percentage points). The bars represent government spending, net exports, private consumption, residential and non-residential investment.

Which of the following is not true?
    a) green bars are private consumption
    b) red bars are non-residential investment
    c) black bars are government spending
    d) blue bars are net export

10) Choose the correct statement for a perfectly competitive market with supply and demand curves looking as usual:
    a) If the government sets the price floor above the equilibrium price, consumers are better off
    b) If the government sets the price floor above the equilibrium price, producers (sellers) are better off
    c) If a government introduces a per-unit tax, the tax revenue is smaller than the combined loss of consumers and producers (sellers)
    d) If a government introduces a per-unit subsidy, the government expenditure is smaller than the combined gain of consumers and producers (sellers)

11) NiceCream, Inc. is a monopolist at the market of ice creams in town N. It enjoys the monopoly profit with the demand function given by D = 100 – P and constant marginal cost MC < 100. Another firm with the same technology is going to enter the market, in this case, the firms will compete by choosing their outputs simultaneously. Choose the correct statement:
    a) The sum of profits of the two firms will be greater than the NiceCream's profit before entry
    b) The sum of outputs of the two firms will be greater than the NiceCream's output before entry
    c) The ice cream price after entry will be higher than before entry
    d) None of the other statements is true

12) Globalization during the late 19th century involved the exchange of agricultural and manufactured goods between land-abundant/labor-scarce countries and labor-abundant/land-scarce countries. Based on this information, which of the following statements is correct?
    a) As a result of specialization, France would export agricultural goods and import manufactured goods
    b) In Russia, the workers would be the winners while the land-owners would be the losers
    c) The U.S. would see the ratio of wages to land rents fall
    d) German workers would demand tariffs on agricultural imports

13) Choose the correct statement regarding economic growth:
    a) Economic growth in all countries of the world has had the same pace in all countries for the last few decades
    b) Compared to the pace of the 20th century, economic growth in the world was very slow before 1700
    c) Economic growth is defined as a long-lasting increase in the country's nominal GDP
    d) All the differences in the pace of economic growth between countries can be explained by their geographical location

14) Rational João Pedro spends all his money on two goods, X and Y, and always knows for sure his optimal bundle. When the prices of both goods are 3, he chooses the bundle (4, 4). Choose the correct statement (other things being equal):
   a) If his income goes up, his consumption of X must increase
   b) If the new prices of goods (X, Y) become (1, 5), it is possible that the bundle (3, 5) becomes the optimal choice
   c) If the new prices of goods (X, Y) become (2, 4), it is possible that the bundle (6, 3) becomes the optimal choice
   d) If the new prices of goods (X, Y) become (2, 4), it is possible that the bundle (2, 5) becomes the optimal choice

15) Two players are negotiating where to place some object on the Cartesian plane. They choose the coordinates (x, y) in the following way: Player A sets the coordinate on the X-axis, Player B sets the coordinate on the Y-axis. Player A wants the object to be as close as possible to the point (2, 4); Player B wants the object to be as close as possible to the point (3, 1). Find the Nash equilibrium location of the object.
   a) (2, 1)   b) (2.5, 2.5)   c) (3, 4)   d) (0, 0)

16) Which of the following is true regarding involuntary unemployment?
   a) Involuntary unemployment is forbidden by law in most countries
   b) If a worker is fired against her will but finds a new job immediately, involuntary unemployment increases
   c) If wages are above the market-clearing (efficiency wages), there is no involuntary unemployment
   d) Setting a minimum wage above the market-clearing wage creates involuntary unemployment

17) If the Central Bank of country K is trying to speed up the recovery of the country's economy using monetary policy, which of the following is correct, other things equal?
   a) The currency of country K is likely to appreciate
   b) It is likely that country K's exports will become cheaper for foreigners
   c) Country K's bonds will go down in prices
   d) The money supply will shrink

18) Choose the correct statement about externalities:
   a) When a person is vaccinated against COVID-19, it creates a positive externality in the future
   b) If some action is associated with negative externality, it must be forbidden to achieve economic efficiency
   c) Positive externalities increase efficiency, so markets with them should not be subject to government intervention
   d) If externality appears in a monopolized market, the inefficiency is doubled and strict regulation is called for

19) Which of the following best describes the Lucas Critique?
   a) The economy of the Galactic Empire in 'Star Wars' is very unrealistic
   b) Economists should not use too much math in their papers
   c) It is generally not a good idea to use relationships found in historical data for policy-making
   d) Consumers do not maximize utility in real life

20) Which of the following is typically not a role of a central bank?
   a) The executor of monetary policy
   b) Lender of last resort
   c) The sole issuer of legal tender
   d) All other options are typical CB's roles

Open Questions

Solve no more than 4 questions out of 5. Indicate your choice of questions.

If you provide solutions for all 5 questions, all of them will be commented on by the Jury, but only 4 will add to your score. In this case, if you do not specify which to grade, the maximum grade of 5 will be excluded.

Every open question is worth 30 raw points.

If not stated otherwise, think of all goods, services and assets as of infinitely divisible. Numbers of firms and people may be only integer.

Convey your ideas clearly. Don't skip important logical transitions in your reasoning.

Good luck!

Question 1. "Dynamic Equilibrium" *(30 raw points)*

Oil (good A) and Gas (good B) are substitutes in consumption; the demand and supply functions are given by:

Good	Demand	Supply
Oil (A)	$D_A = K - 2P_A + P_B$	$S_A = -10 + 2P_A$
Gas (B)	$D_B = 80 - 6P_B + 2P_A$	$S_B = -5 + P_B$

(a) *(5 rp)* Find equilibrium prices $P_A^{\star}$ and $P_B^{\star}$ if $K = 210$.

(b) *(10 rp)* Now consider a dynamic version of this model. We consider the demand for Gas constant for simplicity, but the demand for Oil is volatile. In period t, parameter K takes the value of K_t. Suppose that $K_1 = 210$, so in the first period, the equilibrium from part **(a)** realizes.

For producers of both natural resources, it takes some time to change production capacity, so they have to make a production decision one period before the actual sale occurs. In the first period ($t = 1$), they expect the demand for Oil to fall sharply, so the expected K_2 equals 80. How many units of Oil and Gas will be produced for selling in period 2?

(c) *(5 rp)* The prediction of demand decline turned out to be wrong, so K_2 remained at level 210. Still, the goods are produced, and capacity is exhausted. What prices of Oil and Gas will clear the market?

(d) *(10 rp)* Suppose that starting from period 2, firms' expectations are naïve. This means that they always expect the next period's prices to equal the prices in the current period and make decisions about future production based on this prediction. At the same time, the actual value of K always remains 210. What will happen to prices and outputs when $t \to \infty$?

Question 2. "Effective Lower Bound"   *(30 raw points)*

By the assumption made by many standard textbooks and models, zero is the lower bound of an interest rate, limiting the central bank's capacity to stimulate the economy through monetary policy loosening. This assumption has been disputed recently, as central banks of several countries have set interest rates at negative levels.

Some economists tried to identify (at least theoretically) the interest rate which is, indeed, a lower bound for expansionary monetary policy. They have found that for an interest rate below some (probably negative) level, the further decrease may surprisingly be contractionary. This task will walk you through their reasoning.

(a) *(5 rp)* Explain why zero is sometimes considered the lower bound of an interest rate.

(b) *(5 rp)* Decreased interest rates lead to capital gains on securities owned by banks, improving their capital position. Explain this phenomenon.

(c) *(10 rp)* On the other hand, there is some evidence that when the interest rates go down because of the central bank's decision, commercial banks' net interest margins narrow, causing profitability decline. Explain why this might be the case.

(d) *(10 rp)* If the decline of today's value of future profits outweighs the capital gains, the bank's overall capital position deteriorates. Explain how this may lead to less lending by a bank, making the "stimulus" contractionary.

Question 3. "Pandemic Possibility Frontier"   *(30 raw points)*

Last year, IEO contestants were asked to solve a problem about an optimal lockdown. Unfortunately, in 2021 this topic is no less relevant. So suppose society is facing a severe viral pandemic and contemplates introducing a lockdown. How strong should the lockdown be? The answer to this question apparently depends on the preferences of the society between the lives/health of people and GDP. Or does it really?

Let $d \in [0, 1]$ be the level (strength) of a lockdown ($d = 0$ is no lockdown while $d = 1$ is complete lockdown) and v be some measure of the total amount of virus in circulation. The relation between the two is given by $v = 2(1 - d)$. Aggregate demand in the economy is given by the function $Y = 10 - 2d - P$ while aggregate supply is governed by the equation $Y = 2 + P - d - \alpha \cdot v$ where $\alpha \geqslant 0$ is a parameter; Y is real GDP and P is price level, as usual. Finally, let H be the aggregate health of people; it depends on the amount of virus in circulation as follows: $H = 3 - v/2$.

Define the *Pandemic Possibility Frontier* (PPF, for short) as the set of all pairs (Y, H) that can be achieved by a policy-maker by choosing various levels of lockdown $d \in [0, 1]$.

(a) *(7 rp)* Give a reason for why α may be positive.

(b) *(16 rp)* Sketch the PPF and show the coordinates of its extreme points if $\alpha = 1$ and $\alpha = 2$ (on **two different** diagrams).

(c) *(7 rp)* Suppose the preferences of the society over GDP-Health combinations (Y, H) are given by some family of indifference curves. In practice, no one knows a society's indifference curves exactly; this generates heated debate about the optimal level of lockdown. For which values of α a policy-maker does *not* have to know the society's indifference curves over (Y, H) in order to find the optimal level of lockdown? (The policy-maker still knows all the data in the task and assumes correctly that the society values each of Y and H.)

Question 4. "Pay as You Earn" *(30 raw points)*

Different college graduates earn different salaries, even after graduating from the same institution. Some are less successful or lucky (and thus have lower salaries); others don't pursue maximization of their earnings, leaning towards socially-oriented not-for-profit jobs. Even if student loans are available, students may abstain from entering prestigious and expensive colleges, uncertain that they will be able to repay. This may create an inefficient allocation when most risk-loving and not most talented young people get the best education. (And then some of them fail to pay off the loans.)

Consider the following alternative to a traditional student loan which intends to solve this inefficiency problem. A student enters college tuition-free, and after graduation, they pay the college a certain percentage of their salary for a fixed number of years. So, a student never has to pay for their education more than they earn after receiving it. The income percentage to be paid is calculated based on an average graduate's salary, so the program should finance itself.

(a) *(20 rp)* Despite its apparent advantages, this type of education financing is uncommon. Skills training programs (such as coding academies and bootcamps) are more likely to offer it than prominent universities. Explain why the program designed as described above may fail economically in a large university but is more likely to be feasible in a bootcamp.

(b) *(10 rp)* Suggest a tweak to the program conditions, which might help solve the problem mentioned in **(a)**.

Question 5. "Vaccination Dilemmas" *(30 raw points)*

The city of Vaccineville has a lot of residents. During the coronavirus pandemic, the city authorities are not imposing a lockdown but are urging all residents to get vaccinated. A vaccine is available in the city and can be administered to any resident who wants to get it.

The likelihood for a person P to contract the coronavirus depends on whether he or she is vaccinated, as well as what proportion of other residents are vaccinated. For simplicity, assume that every day all residents meet in random pairs, so the probability of meeting a vaccinated person equals the proportion α of residents that are vaccinated (assume that the population is very large, so whether one person is vaccinated does not affect α to any significant extent). The risk for person P to contract the coronavirus in different matches are given by their probability of being infected that are included in the following table:

Person P...	...and meets smb. vaccinated	...and meets smb. non-vaccinated
...is vaccinated...	0	0.05
...is not vaccinated...	0.15	0.4

All residents consider vaccination a costly procedure. Even though the vaccine is offered free of charge, the cost may come in the form of the time needed to be spent visiting a doctor, lack of trust in the effectiveness and safety of the vaccine, side effects, etc. A person's utility equals the probability of *not* being infected when she meets someone. For those vaccinated, the cost of vaccination that is equal to 0.3 is subtracted from utility.

(a) *(10 rp)* Suppose people decide individually whether to get vaccinated; each of them maximizes their utility. We say that people's decisions form a *Nash equilibrium* if no one can

benefit by changing their decision with others' decisions fixed. What fraction of Vaccineville residents will get vaccinated in the Nash equilibrium?

(b) *(10 rp)* Vaccinetown is just like Vaccineville in all aspects, except that its authorities force some of its citizens to get vaccinated. In particular, vaccination is mandatory for doctors and teachers, which together constitute 20% of the town's population. All other residents decide individually whether to get vaccinated or not. What fraction of Vaccinetown residents will get vaccinated in the Nash equilibrium?

(c) *(10 rp)* Now suppose that cost of vaccination is different across the population. It is not 0.3 for everyone, but instead, it ranges from zero for some people to very high for others. The authorities want to shift the equilibrium so that more people get vaccinated by making vaccination mandatory for some of them. They know what groups of people have low, medium, and high vaccination costs and can choose for whom to make vaccination mandatory. Knowing that it is politically infeasible to make vaccination mandatory to *everyone*, what is your recommendation regarding this matter? Explain using the concept of Nash Equilibrium.