# AFRICAN ECONOMIC RESEARCH CONSORTIUM

***Collaborative PhD Programme in Economics for Sub-Saharan Africa***

***COMPREHENSIVE EXAMINATIONS IN CORE AND ELECTIVE FIELDS***

**JANUARY 28 – FEBRUARY 17, 2020**

# MICROECONOMICS

**Time: 08:00 – 11:00 GMT** **Date: Monday, February 3, 2020**

## INSTRUCTIONS:

1. Answer a total of FOUR questions: ONE question from Section A; ONE question from Section B; and TWO questions from Section C (One of which **MUST** be **Question 5)**.
2. Please note that **Question 5** in Section C is **Compulsory**.
3. The sections are weighted as indicated on the paper.

## SECTION A: (15%)

***Answer only ONE Question from this Section***

### Question 1

Using illustrations,

(a) Explain the law of diminishing returns under one variable factor of production. **[7.5 Marks]**

(b) Explain why the average productivity curve is increasing when marginal productivity is above average productivity, and decreasing when marginal productivity is below average productivity. **[7.5 Marks]**

### Question 2

(a) Using illustrations, explain how a legal maximum price (price ceiling), and a legal minimum price (price floor) imposed by the government can lead to shortages and surpluses, respectively, in the market of Fufu corn. **[10 Marks]**

(b) Explain why in a perfectly competitive market, a firm can make an economic profit only in the short run. **[5 Marks]**

## SECTION B: (25%)

***<u>Answer only ONE Question from this Section</u>***

### Question 3

(a)

(i) What do you understand by the term "Expected Utility"? **[5 Marks]**

(ii) Explain carefully the axioms of consumer behaviour under uncertainty. **[10 Marks]**

(b) Assume that a consumer has the following expected utility function:

$$u(x) = -2ae^{-rx} + b$$

(i) Obtain the risk aversion measures for the consumer. **[3 Marks]**

(ii) Is the consumer risk averse, risk neutral or a risk lover? **[2 Marks]**

(iii) What are the factors that influence the measures of risk averseness of a consumer? **[5 Marks]**

### Question 4

The Constant Elasticity of Substitution (CES) is a general form of a production function developed by Arrow, Chenery, Minhas and Solow (1961) expressed as follows:

$$y = f(x_1, x_2) = \left(x_1^{\rho} + x_2^{\rho}\right)^{\frac{\varepsilon}{\rho}}$$

Where $\rho \leq 1, \rho \neq 0, \varepsilon > 0$

(a) Calculate the elasticity of technical substitution of this CES function $(\sigma)$. **[10 Marks]**

(b) Depending on the possible values that can be taken by $(\rho)$, explain why it is said that the CES function is a general form of the three following major production functions, namely: the Cobb-Douglas production function, the Fixed proportion production function, and the perfect substitutes production function. **[8 Marks]**

(c) Explain the relationship between the elasticity of technical substitution and the curvature of the isoquant. **[7 Marks]**

## SECTION C: (60%)

***Answer TWO Questions from this Section,***

***One of which MUST be Question 5, which is COMPULSORY***

## Question 5 (Compulsory)

Define briefly the **underlined concepts** in **any five (5)** of the following statements and then **explain** whether the statements you have chosen are **true** or **false**.

(a) The **Hicksian demand functions** $h_i = h_i(p_i, u)$ are **homogeneous of degree zero in prices**. **[6 Marks]**

(b) One of the **Marshallian Demand functions** for a two-good **quasi-linear utility function** is independent of income. **[6 Marks]**

(c) The **Weak Axiom of Revealed Preference** is a necessary and sufficient condition for **utility maximisation**. **[6 Marks]**

(d) **Hotelling's lemma** allows us to derive the **supply function** from the profit function. **[6 Marks]**

(e) If a **natural monopoly** is to operate at the efficient output level by adopting **marginal cost pricing**, it will need a subsidy to stay in production. **[6 Marks]**

(f) The outcomes of **Bertrand duopoly** model differ from **Cournot duopoly** despite both models being applications of the same equilibrium concepts. **[6 Marks]**

(g) In contrast to a **separating equilibrium**, in a **pooling equilibrium**, insurance companies can distinguish high risk customers from low risk customers. **[6 Marks]**

(h) The **market for lemons** a la Akerlof can be characterized as a game of **asymmetric information**. **[6 Marks]**

## Question 6

(a) Given a Cobb-Douglas utility function $u(x_1, x_2) = x_1^{\alpha_1} x_2^{\alpha_2}$; where $p_1$ and $p_2$ are the per-unit prices of Good 1 and Good 2, respectively; $x_1$ and $x_2$ are respective quantities of good 1 and good 2 consumed, and $M$ is the consumer's money income.

(i) Derive the Hicksian demand functions, $h_i = h_i(p, u),\ i = 1, 2$. **[10 Marks]**

(ii) Derive the expenditure function, $e = e(p, u)$. **[5 Marks]**

(b) Now, assume that:

$$\alpha_1 < 1;\ \alpha_2 < 1;\ \alpha_1 = \alpha_2;\ \sum_i \alpha_i = 1$$

(i) Use duality to derive the Indirect Utility function, $V = V(p, M)$ **[5 Marks]**

(ii) Derive the Marshallian Demand functions, $x_i = x_i(p, M)\ i = 1, 2$ **[5 Marks]**

(iii) Compute the Equivalent Variation (EV) and the Compensated Variation (CV), given the initial price vector $p^0 = (5, 5)$, new price vector, $p' = (1,\ 5\ )$ and $M=25$. **[5 Marks]**

## Question 7

Consider Akerlof's "Market for Lemons". There is a continuum of potential buyers of used cars, and a continuum of potential sellers, where each set is normalized to be of measure one. Each seller has one car to sell, and each buyer desires to purchase one car. The quality, $x$, of each seller's car is private information. Buyers know the distribution of quality, which is uniform on [1, 2]. A buyer's monetary-valued utility from a car of quality $x$ is $\alpha x$; a seller's monetary-valued utility of retaining his car of quality $x$ is simply $x$. Consequently, if a seller sells a car of quality $x$ at a price $p$, her payoff is $p - x$ and the buyer's payoff is $\alpha x - p$.

(a) Determine the competitive equilibrium in this used car market for every value of α ϵ [1, 2]

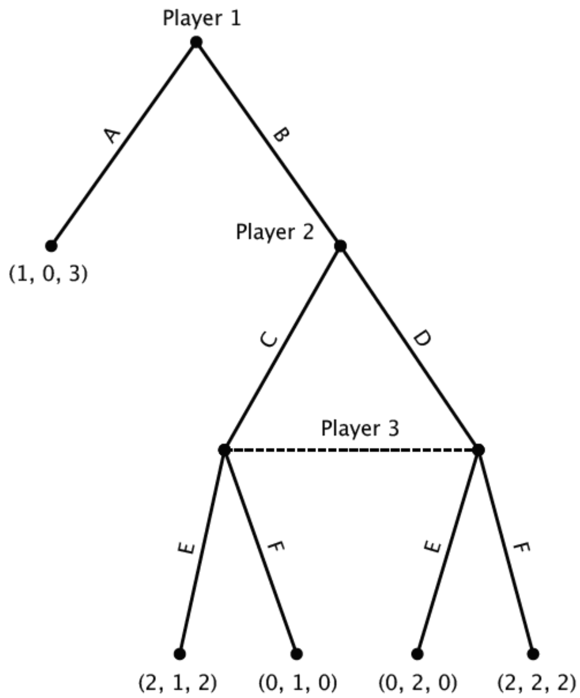
(i) When only a fraction of the cars are traded. **[15 Marks]**

(ii) When all cars are traded. **[10 Marks]**

(b) Comment on Pareto Efficiency of the solutions. **[5 Marks]**

## Question 8

Consider the strategic interaction represented in extensive form below:




(a) Represent this game in normal form and solve for the pure strategy Nash equilibrium/equilibria. **[12 Marks]**

(b)

(i) How many subgames does this game have? **[1 Mark]**

(ii) Solve for the subgame perfect Nash equilibrium. **[7 Marks]**

(c) Find beliefs that make the strategy profile (A, D, E) sequentially rational for the players and thereby extend this strategy profile to a weak perfect Bayesian equilibrium. Let $\mu$ represent the belief probability assigned to the left node in player 3's information set and, therefore, $1-\mu$ is the belief probability assigned to the right node in player 3's information set. **[10 Marks]**