Computer problems 04

Task 1. There are N clothing stores in the city that operate under monopolistic competition. Each store offers its own clothing model and sets a price for it. The costs of producing one unit of product for each store consist of a fixed cost of M UAH and a variable cost of k*M UAH (0<k<0.4) per unit of product. In addition, each store has advertising costs, which consist of fixed costs and variable costs (for each unit of product). The total demand for clothing consists of three groups of consumers. The first group is able to purchase clothing for a price of up to 1000 UAH, the second group is able to purchase clothing for a price of up to 1500 UAH, and the third group is able to purchase clothing at any price. The number of consumers in each group is from 1 to 15 thousand people. Suppose that stores have the ability to apply price discrimination and set prices at different levels for each group of consumers. Determine the optimal pricing strategy for each store and the total sales volume of clothing in dynamics.

Task 2. There are 5 firms with a production function Q = 30L in the market for product X, where Q is the quantity of the product produced by the firm, L is the number of employees. The price of the finished product is P per unit. Each firm has equal access to resources and its wage costs for each employee are W. Let there be three groups of consumers in the market: poor, middle and rich, with the following utility functions:

Poor: U(x) = x^0.4, where x is the quantity of the product purchased.

Middle: U(x) = x^0.6 + I^0.4, where I is the consumer's income.

Rich: U(x) = x^0.8 + 2I^0.2.

The firms created a cartel in order to increase their profits. It is necessary to model the activities of the cartel and its possible collapse in dynamics.

Task 3. There is an energy market in the region with three suppliers who have production functions: Q1 = 20 * E1^(0.8) for supplier 1, Q2 = 15 * E2^(0.9) for supplier 2 and Q3 = 25 * E3^(0.6) for supplier 3, where Q is the amount of energy (in MW), E is the cost of energy resources (in million UAH). The demand for energy is described by the function P = 300 - 0.02(Q1 + Q2 + Q3), where P is the price per MW. The suppliers' costs consist

of a fixed part (10 million UAH for all) and a variable part (C1 = 5E1, C2 = 7E2, C3 = 6E3). Consumers are divided into three groups with utility functions: U1 = Q^(0.5) for households, U2 = Q^(0.7) * I^(0.3) for small businesses and U3 = Q^(0.9) for industry, where I is the income of the groups (10 thousand, 50 thousand and 200 thousand UAH respectively). Suppliers can apply partial price discrimination depending on the groups of consumers. Model the market equilibrium according to the oligopoly algorithm, determine the optimal production volumes, prices for each group and suppliers' profits, plot price and volume dynamics, and analyze the impact of introducing a state subsidy for energy resources on the equilibrium state.