Strathmore
UNIVERSITY

ASSIGNMENT

Question One (20 Marks)

(i) A chicken farmer can buy a special food mix A at 20c per Kg and special food mix B at 40c per Kg. Each Kg of mix A contains 3000 units of nutrient N_1 and 1000 units of nutrient N_2; each Kg of mix B contains 4000 units of nutrient N_1 and 4000 units of nutrient N_2. If the minimum daily requirements for the chickens collectively are 36000 units of nutrient N_1 and 20000 units of nutrient N_2, how many pounds of each food mix should be used each day to minimize daily food costs while meeting (or exceeding) the minimum daily nutrient requirements? What is the minimum daily cost?

(ii) A farmer can buy two types of plant food, mix A and mix B. Each cubic metre of mix A contains 20 kg of phosphoric acid, 30 kg of nitrogen, and 5 kg of potash. Each cubic metre of mix B contains 10 kg of phosphoric acid, 30 kg of nitrogen and 10 kg of potash. The minimum monthly requirements are 460 kg of phosphoric acid, 960 kg of nitrogen, and 220 kg of potash. If mix A costs E30 per cubic metre and mix B costs E35 per cubic metre, how many cubic metres of each mix should the farmer blend to meet the minimum monthly requirements at a minimal cost? What is the cost?

(iii) A laboratory technician in a medical research centre is asked to formulate a diet from two commercially packaged foods, food A and food B, for a group of animals. Each kg of food A contains 8 units of fat, 16 units of carbohydrates, and 2 units of protein. Each Kg of food B contains 4 units of fat, 32 units of carbohydrate and 8 units of protein. The minimum daily requirements are 176 units of fat, 1024 units of carbohydrate, and 384 units of protein. If food A costs 5c per Kg and food B costs 5c per Kg, how many kilograms of each food should be used to meet the minimum daily requirements at the least cost? What is the cost of this amount?

(iv) A can of cat food, guaranteed by the manufacturer to contain at least 10 units of protein, 20 units of mineral matter, and 6 units of fat, consists of a mixture of four different ingredients. Ingredient A contains 10 units of protein, 2 units of mineral matter, and 1 2 unit of fat per 100g. Ingredient B contains 1 unit of protein, 40 units of mineral matter, and 3 units of fat per 100g. Ingredient C contains 1 unit of protein, 1 unit of mineral matter, and 6 units of fat per 100g. Ingredient D contains 5 units of protein, 10 units of mineral matter, and 3 units of fat per 100g. The cost of each ingredient is 3c, 2c, 1c, and 4c per 100g, respectively. How many grammes of each should be used to minimise the cost of the cat food, while still meeting the guaranteed composition?

Question Two (20 Marks)

(i) A factory manufactures two products, each requiring the use of three machines. The first machine can be used at most 70 hours; the second machine at most 40 hours; and the third machine at most 90 hours. The first product requires 2 hours on Machine 1, 1 hour on Machine 2, and 1 hour on Machine 3; the second product requires 1 hour each on machines 1 and 2 and 3 hours on Machine 3. If the profit in E40 per unit for the first product and E60 per unit for the second product, how many units of each product should be manufactured to maximize profit?

(ii) Namboard produces two gift packages of fruit. Package A contains 20 peaches, 15 apples and 10 pears. Package B contains 10 peaches, 30 apples and 12 pears. Namboard has 40,000 peaches, 60,000 apples and 27 000 pears available for packaging. The profit on package A is E2.00 and the profit on B is E2.50. Assuming that all fruit packaged can be sold, what number of packages of types A and B should be prepared to maximize the profit?

(iii) An company manufactures two electrical products: air conditioners and large fans. The assembly process for each is similar in that both require a certain amount of wiring and drilling. Each air conditioner takes 3 hours of wiring and 2 hours of drilling. Each fan must go through 2 hours of wiring and 1 hour of drilling. During the next production period, 240 hours of wiring time are available and up to 140 hours of drilling time may be used. Each air conditioner sold yields a profit of E25. Each fan assembled may be sold for a profit of E15. Formulate and solve this linear programming mix situation to find the best combination of air conditioners and fans that yields the highest profit.

(iv) A manufacturer of lightweight mountain tents makes a standard model and an expedition model for national distribution. Each standard tent requires 1 labour hour from the cutting department and 3 labour hours from the assembly department. Each expedition tent requires 2 labour hours from the cutting department and 4 labour hours from the assembly department. The maximum labour hours available per day in the cutting department and the assembly department are 32 and 84 respectively. If the company makes a profit of E50 on each standard tent and E80 on each expedition tent, use the graphical method to determine how many tents of each type should be manufactured each day to maximize the total daily profit?