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**A. M. E. C. E. A**

**MAIN EXAMINATION**

**JANUARY – APRIL 2022**

**FACULTY OF SCIENCE**

**DEPARTMENT OF MATHEMATICS AND ACTUARIAL SCIENCE**

**REGULAR PROGRAMME**

**MAT 463: OPERATIONS RESEARCH III**

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| **Date: APRIL 2022 Duration: 2 Hours** |
| **INSTRUCTIONS: Answer Question ONE and any other TWO Questions** |

Q1.

1. A company sells two types of items A & B. Item A sells for kshs. 25 per unit. No quantity discount is given. The sales revenue for B decreases as the number of its unit sold increases. How many units can the company procure for sale in the next year? **[5marks]**
2. Obtain the Khun-Tucker conditions for a solution of the problem **[5marks]**
3. A manager must choose between two investments A & B that are calculated to yield net profit of $1200 and $1600, respectively with probabilities subjectively estimated at 0.75 and 0.60. Assume the manager’s utility function reveals that utilities for $1200 & $1600 are 45 and 60 units, respectively. What is the best choice on the basis of the expected utility value (EUV)? **[5marks]**
4. State applications of Markov analysis. **[5marks]**
5. A sale’s man territory consists of cities A, B and C. He never sells in the same city in successive days. If he sells in city A, then the next day he sells in city B. However if she buys either B or C, then the next day he is twice as likely to sell in city A as in the other city. In the long run, how often does he sell in each of the cities? **[5marks]**
6. What is goal programming? Clearly state its assumptions **[5marks]**

Q2.

1. State the steps to formulate a GP model **[6marks]**
2. Use modified simplex method to solve the following GP problem. **[14marks]**

Minimize $Z=P\_{1}d\_{1}^{-}+P\_{2}\left(2d\_{2}^{-}+d\_{3}^{-}\right)+P\_{3}d\_{1}^{+} subject to the constraints $

$$i. x\_{1}+x\_{2}+d\_{1}^{-}-d\_{1}^{+}=400 ii. x\_{1}+d\_{2}^{-}=240 iii. x\_{1}+d\_{3}^{-}=300$$

Q3.

1. Use Wolfe’s method to solve the quadratic programming problem; **[20marks]**

Maximize $Z=4x\_{1}+6x\_{2}-2x\_{1}^{2}-2x\_{1}x\_{2}-2x\_{2}^{2}$ subject to the constraint

$$x\_{1}+2x\_{2}\leq 2 and x\_{1}, x\_{2}\geq 0$$

Q4.

1. Mr. Max has an after tax annual of Rs. 90000 and he is considering to buy accident insurance for his car. The probability of accident during the year is 0.1, in which case the damage to the car will be Rs. 11, 600. With utility function of $U\left(x\right)=\sqrt{x}$ what is the insuarance premium he will be willing to buy. **[8marks]**
2. On January this year, bakery A had 40% of its local market share while the other two local bakeries B & C had 40% and 20% respectively of the market share. On a study by a marketing research, the following facts were compiled. Bakery A retains 90%of its own customers while gaining 5% of B’s customers and 10% of C’s customers. B retains 85% of its customers, gains 5% of A’s customers and 7% of C’s customers. C retains 83% of its customers, gains 5% of A’s and 10% of B’s. What will each firm share be in January next year and what will each firm’s market share be at equilibrium?  **[12marks]**

Q5.

1. State some problem areas in management where goal programming might be applicable.

 **[8 marks]**

1. Why are the derivational variables associated with a particular goal complementary?

  **[7 marks]**

1. What is the difference between a positive and negative deviational variable?**[5 marks]**

**\*END\***