

# HW#5

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#1

Indices and Data :

$$m \in \text{month} = [1, \dots, 12]_m$$

$$d \in \text{demand} = [\text{dem}1, \dots, \text{dem}12]_m$$

$$\text{SP} > \text{sellprice} = [\text{sellprice}]_m - \text{in } \$$$

$$\text{CP} > \text{calveprice} = [\text{calveprice}]_m - \text{in } \$/\text{year}$$

$$\text{P} > \text{calvingproduction} = [\text{calvingproduction}]_{\text{calfmonth}, \text{producemonth}} - \text{in gallons/calved cow}$$

$$\text{Z} > \text{days per month} = [31 \dots, 31]_m - \text{in days per month}$$

Decision Variables:

$$X_m = [\text{cowscalved}]_m - \text{in cows calved in month 'm'}$$

$$E_d = \text{excess of demand of milk in month 'm'}$$

$$S_d = \text{shortage of demand of mil in month 'm'}$$

Objective Function:

$$\text{MIN} \sum_{m \in \text{months}} \text{CP}_m * X_m + \sum_{d \in \text{months}} \text{SP}_d * S_d + \sum_{d \in \text{months}} 0.2 * \text{SP}_d * E_d$$

Sum of the yearly cost to feed the number of cows calved in all months of the year plus the money lost due to a shortage of milk produced in all months plus the money lost due to the surplus of milk produced in all months. Sum of all start up costs and revenue losses due to choices in production, amount of excess, and amount of shortage.

ST:

- 1) Ensure that the total milk produced, the excess, and the shortage all combine to equal the monthly demand:

$$\sum_{m \in \text{months}} X_m * P_{d,m} * Z_m - E_d + S_d = \text{dem}_d; \quad \forall d \in \text{months}$$

All cows calved in all months  $m$  must produce a total amount of milk, which minus the excess and plus the shortage meets the monthly demand. The production, excess, and shortage must all combine to equal the monthly demand.