Homework 05 (60 Points)

Problem 1 (30 Points): Dairy cows calve on a regular annual basis. Their milk output varies over the year accordingly with the peak being reached a few months after calving followed by a decrease and eventually reaching nearly 0 in the 10th month following calving. Knowing these facts, farmers in a dairy cooperative are trying to plan calving during the months: $C = \{1,2,3,4,5,6,7,8,9,10,11,12\}$ to make it easier to meet seasonal milk demands in months: $D = \{1,2,3,4,5,6,7,8,9,10,11,12\}$. Any milk produced in excess of monthly demands will go to waste and treated as a 20% loss of potential revenue. Shortage of the monthly demands will be treated as a loss of 100% of the expected sales price for that gallon of milk.

Over time, farmers have gathered enough information to know how many gallons of milk a cow that calved in month "c" will produce in demand month "d" – this milk production is reported as P where $p_{d,c}$ is the gallons of milk produced in demand month "d" from a cow that calved in month "c". Determine the minimum cost solution (which includes the number of cattle the coop's dairy farmers have to have and in which months they need to calf in order to ~~meet the monthly demand~~ <u>minimize any incurred expenses or loss of revenue</u>).

The following data is available in data files for this problem:

      feedstock.csv:= The annual cost associated with sustaining a cow that calved in month "c"

      demand_price.csv:= The amount of milk (in gallons) the coop is expected to deliver each month "d" and the expected retail sales price for each gallon of milk sold by the coop

      production.csv:= The amount of milk that a cow that calving in month "c" will produce in month "d" (*for this file, the calving months are in the first column of data while the demand months are in the first row of the data*)