Problem 1:

1. Grimes came to this solution because if all of the “Grade A” grapes, A, were used (930,000 pounds) then the maximum number of “Grade B” grapes, B, would be:

930,000\*9+B\*5 >= (930,000+B)\*8

930,000\*9+B\*5 >= 903,000\*8 + B\*8

930,000 >= B\*3

310,000 >= B

So, the maximum B can be while meeting the quality requirements is 310,000 pounds. Giving us a maximum of 930,000+310,000=1,240,000 pounds of raw material.

1. Bollman computes the fruit cost by finding the ratio of “A Grade” grapes to “B Grade” grapes, calculating the total pounds of each grade per product, then multiplying each result by the corresponding price.

Ex) For Raisins:

Calculate min A:B ratio

A\*9+B\*5 = 8\*(A+B)

A\*9+B\*5 = 8\*A + 8\*B

A=3\*B

Pounds for Raisin Product

A+B = 6.5

3\*B + B = 6.5 #Substitution from above

B = 1.625

A = 4.875

Get Price

4.875\*.45 + 1.625\*.25 = 2.60

1. Part C code below
   1. Raisin: 54359, Juice: 190,000, Jelly: 177,037
   2. No grapes are leftover
   3. Jelly:$2.89 > Juice:$2.18 > Raisin:$0.52, Total Profit :$959,540
   4. Raisins: 8, Juice: 6, Jelly: 5
   5. The shadow price of A-grade grapes is .07 (over the .45 current cost), so the shadow price is .52
   6. They should buy the grapes as the cost of .50 is greater than the shadow price of .52 and the upper bound on that shadow price will not bet met with those 300,000 pounds
   7. A Grade: .51 as the shadow price is .52

B Grade: .40 as the shadow price is .41

Text

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1. Part D code below
   1. Raisin: 54359, Juice: 190,000, Jelly: 177,037. Thomas’ profit contribution is the same at $959,540. The shadow price of “Grade A” grapes using Thomas’ numbers is .24 Text

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   2. Raisin: 0, Juice: 172,857, Jelly: 210,000. Bollman’s profit contribution is greater at $983,729. The shadow price of “Grade A” grapes using Bollman’s numbers is .15

Jelly: $945,000

Juice: $725,999.4

Total: $1,670,999.4

Actual:$1,736,000

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* 1. Thomas and Bollman both assume the price of fruit before calculating their mixes and include it in their profit equation, resulting in wrong calculations.

When we observe the results using Bollman’s numbers we see that we produce 0 raisin products. This is because the ratio of A:B grapes is lower in the other products and even though we are using more expensive grapes in the mix this is not being accounted for. Essentially her model lowers the cost of the product already purchased.

Observing Thomas’ answers he gets the correct profit and product mix however because he assumes fruit price beforehand it throws off his values for the shadow price and cost of making products. So his model is not accurate for deciding purchase prices.

My model takes in to account cost of fruit but doesn’t predetermine what mix will be used for each product resulting in a better and more accurate model for both ingredient allocation and purchase prices.