

Section B: Report to the client

Task:

1. Brief insights into the: solution, such as identifying key constraints or explaining the effects of the additional requirements and options on costs. 3 marks

Communication 1

Based on your initial communication, we understand you desire to determine the volume of whole and low fat milk which should be produced from your total supply to maximise income, all subject to constraints on milk fat.

Your pricing for each of the milk types - whole and low fat - indicates that low fat milk production should be maximised as it shall reap the greatest profit. However, due to the requirement that all fat of your supply is to be used, a large proportion of your supply must still be processed into whole milk to use up this fat in supply.

Through mathematical modelling, it was determined that to optimise profit, 35317L of whole milk and 5183L of low fat milk should be processed from the supply of the five farms.

Communication 2

In response to Haven and Silo Springs converting to organic production and the inclusion of your new organic products, the model we provided previously has been revised to include additional constraints.

In this revised model, organic milks will now achieve the greatest profit and so, it is inferred that these products will be maximised.

We have ensured that all organic products are processed only from the supply of the organic suppliers - Haven and Silo Springs. Based on your communication with us, it was also specified that the fat content of organic product is equal to the fat content of organic supply, and similarly for non-organic product and supply.

With the addition of these new constraints, our mathematical formulations suggest you process 14363.33L of whole organic milk, 1936.67L of low fat organic milk, 20953.33L of whole milk and 3246.67L of low fat milk from your total supply.

Communication 3

Thank you for bringing these marketing restrictions to our attention. In response to these restrictions, we have revised our model.

We have added constraints on the percentage of production which can be low fat for each of organic and non-organic products. Further, it is constrained that no more than 15% of production is organic.

The revised model suggests that from the total supply, 4556.25L of whole organic milk, 1518.75L of low fat organic milk, 25818.75L of whole milk and 8606.25L of low fat milk is processed.

Communication 4

We are pleased to hear of your increased revenue and have devised a new model to optimise your operations based on your new suppliers and the changed requirements of your operation.

In this new model, as requested, we have removed all constraints regarding organic products and focus only on standard whole milk and low fat milk. In line with the new information regarding demand for the products, we have implemented a constraint to ensure that the volume of sold milk of each type does not exceed demand on any given day.

Similarly to our previous responses, the percentage fat in the product is less than or equal to the percentage fat of supply to reflect what is realistically possible in such a scenario.

The wholesale price of low fat milk is greater than the wholesale price of whole milk, so it is intuitive that the solution maximises low fat milk production and this is reflected in the results.

As there is no limit on production apart from the limit on supply from each farm, the final solution reflects that demand is met on each day.

Our devised plan using mathematical modelling is as follows:

Day	Category	Sold(L)	Demand(L)	Day	Category	Amount(L)
<i>Mon</i>	Whole	13778	13778	<i>Mon</i>	Whole	18774.33
	Low Fat	3485	3485		Low Fat	10462.6
<i>Tue</i>	Whole	27488	27488	<i>Tue</i>	Whole	31039.67
	Low Fat	6896	6896		Low Fat	10313.33
<i>Wed</i>	Whole	68427	68427	<i>Wed</i>	Whole	2366
	Low Fat	17060	17060		Low Fat	0
<i>Thu</i>	Whole	13740	13740	<i>Thu</i>	Whole	25826
	Low Fat	3543	3543		Low Fat	5757
<i>Fri</i>	Whole	27428	27428	<i>Fri</i>	Whole	37218.67
	Low Fat	6756	6756		Low Fat	678.3
<i>Sat</i>	Whole	27519	27519	<i>Sat</i>	Whole	49453
	Low Fat	6794	6794		Low Fat	6633
<i>Sun</i>	Whole	81853	82193	<i>Sun</i>	Whole	0
	Low Fat	20733	20733		Low Fat	0

Communication 5

We recognise the importance of this constraint on duration of milk storage and have once again updated our model to reflect this requirement.

To address the constraint, we have enforced that each day the cumulative sold milk must include any milk stored from yesterday. This ensures that there will never be milk in storage for more than one day and no stored milk goes to waste.

Using this new model, the optimised plan for your milk processing over the next seven days is as follows:

Day	Category	Sold(L)	Demand(L)	Day	Category	Amount(L)
<i>Mon</i>	Whole	13778	13778	<i>Mon</i>	Whole	19975
	Low Fat	3485	3485		Low Fat	6896
<i>Tue</i>	Whole	27488	27488	<i>Tue</i>	Whole	32240.33
	Low Fat	6896	6896		Low Fat	6746.67
<i>Wed</i>	Whole	68427	68427	<i>Wed</i>	Whole	0
	Low Fat	17060	17060		Low Fat	0
<i>Thu</i>	Whole	13740	13740	<i>Thu</i>	Whole	15241
	Low Fat	3543	3543		Low Fat	6756
<i>Fri</i>	Whole	27428	27428	<i>Fri</i>	Whole	27519
	Low Fat	6756	6756		Low Fat	6794
<i>Sat</i>	Whole	27519	27519	<i>Sat</i>	Whole	39753.33
	Low Fat	6794	6794		Low Fat	6746.67
<i>Sun</i>	Whole	72267	82193	<i>Sun</i>	Whole	0
	Low Fat	20733	20733		Low Fat	0