Optimisation Project

ENGSCI 355, S2 2018

Problem Description

Kemito Pipfruit pack and distribute apples and avocadoes. They have a number of suppliers that provide them with produce that is then packed and shipped to a number of markets. Kemito is investing in new, automated packing machines at their 4 packhouses. Their two lines of produce, apples and avocadoes, are completely separate so they need a distribution and (packing machine) investment plan for each line. There are 4 suppliers and 5 markets for avocadoes and 10 suppliers and 15 markets for apples. In addition, although Kemito has guaranteed contracts with their suppliers, the demand in each market is not known beforehand. Kemito has 10 periods of historical data for the demand in each market for both avocadoes and apples.

Supply/Demand Data

The supply and demand data for apples and avocadoes is given in Tables 1 and 2. Note that avocado data is given first as it has lower volume and less suppliers/markets.

Table 1. Supply Demand data for Avocadoes

			Demand (Units/Period – Historical)									
Supplier	**Supply (Units/ Period)**	**Market**	1	2	3	4	5	6	7	8	9	10
S1	531	D1	6	1953	1976	262	1101	145	10	109	335	719
S2	285	D2	1609	12	58	131	407	1159	306	98	1240	224
S3	983	D3	326	77	8	524	67	160	1665	106	58	1077
S4	264	D4	85	9	7	765	64	180	5	1439	70	20
		D5	35	9	13	173	216	210	74	102	152	20

Table 2. Supply Demand data for Apples

			Demand (Units/Period – Historical)									
Supplier	**Supply (Units/ Period)**	**Market**	1	2	3	4	5	6	7	8	9	10
S1	69	D1	173	12	1138	1854	116	4	26	868	141	180
S2	10	D2	50	715	67	82	101	2	2	38	125	172
S3	841	D3	114	12	233	71	52	5	1754	10	100	74
S4	195	D4	17	32	884	120	32	5	3	10	431	93
S5	945	D5	78	17	221	66	32	2	4	10	278	57
S6	357	D6	209	12	524	66	72	3	2	49	1286	53
S7	364	D7	21	42	146	225	29	2	2	36	100	2266
S8	968	D8	1644	10	81	74	84	6	11	10	193	53
S9	594	D9	32	11	111	254	131	2	6	14	306	97
S10	14	D10	29	19	62	84	45	14	2	3178	104	89
		D11	47	10	74	71	2475	4218	15	14	193	53
		D12	195	351	121	467	32	2	4	11	100	55
		D13	1570	12	97	336	655	5	16	14	104	304
		D14	16	2846	60	77	30	2	14	52	100	80
		D15	155	249	93	66	29	76	2488	36	350	289

Packhouse Data

There are three different sized automated packing machines that Kemito are considering. Each packhouse can contain as many of each type of machine as necessary, but machines are pre-configured for apples or avocadoes, not both.

The data on the machines is given in Table 3.

Table 3. Data for Packing Machines

Size	**Average Packing Rate (Units/Period)**	**Cost ($1,000s)**
Small	100	10
Medium	375	25
Large	500	35

The transportation cost from the suppliers and markets to/from the packhouses are given in Tables 4 and 5 (for avocadoes and apples respectively).

Table 4. Transportation Cost to/from packhouses for Avocado suppliers/markets

Cost ($/unit) From/To	T1	T2	T3	T4
S1	21	84	42	93
S2	38	61	5	51
S3	67	9	74	89
S4	48	4	11	18
D1	77	73	16	64
D2	97	33	40	91
D3	60	66	14	90
D4	96	46	63	44
D5	44	97	52	70

Table 5. Transportation Cost to/from packhouses for Apple suppliers/markets

Cost ($/unit) From/To	T1	T2	T3	T4
S1	65	34	44	38
S2	3	35	79	35
S3	68	10	3	32
S4	80	90	80	2
S5	73	98	36	9
S6	80	56	47	48
S7	20	63	72	67
S8	87	47	72	20
S9	24	68	83	1
S10	32	20	96	36
D1	93	51	99	41
D2	66	92	71	46
D3	42	90	10	53
D4	19	57	64	29
D5	58	15	2	59
D6	24	87	83	1
D7	59	72	29	61
D8	97	99	48	29
D9	22	78	39	57
D10	84	20	68	19
D11	51	8	39	83
D12	2	14	99	38
D13	85	14	6	48
D14	7	93	1	71
D15	92	40	79	75

Deliverables

For the optimisation part of the ENGSCI 355 project, each group must deliver:

1) A group report of at most 3×A4 sides, detailing your model and solution, due by the Wednesday lab of week 7. Be sure to include background, any relevant data processing steps, model description and your best distribution and (packing machine) investment plan for both apples and avocadoes. An “editor” version of the report is due by the Wednesday lab of week 6 (for aegrotat purposes, not marked, but used for evaluation purposes in the case that the editor does not sit the final exam). **Groups must determine their editors for each of the 3 reports (Optimisation, Conceptual Model, and Simulation) and let Mike know by start of week 5.**
2) A group presentation on the group’s optimisation model, given in the Wednesday lab of week 6.