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HOMEWORK 5

PRODUCTION PLANNING & SCHEDULING

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Section 4.5

Problem 14

A.

The optimal order size and frequency of hex nuts and molly screws for a local machine shop is given below in Table 1. Q* represents the order size for each respective product, and T* represents the time between orders for each respective product.

Table 1: Local Machine Shop's Optimal EOQ Metrics

Metric	Value	Units
Q*_hex	10328	[unit/order]
Q*_molly	5429	[unit/order]
T*_hex	0.5164	[years/order]
T*_molly	0.3878	[years/order]

B.

The average annual holding/setup cost by ordering each product at its respective order size and order frequency is given below in the first row of Table 2. The average annual holding/setup cost of ordering both products at the hex nut's optimal time between orders, to reduce set up costs, is given below in the second row of Table 2. The average annual holding/setup cost of ordering both products at the molly screw's optimal time between orders, to reduce set up costs, is given below in the third row of Table 2. The comparison of values below indicates that not taking advantage of the reduced set up costs, and just following the optimal economic ordering policy for each product is more cost-effective.

Table 2: Local Machine Shop's EOQ Model Comparison

Metric	Value	Units
HK(Q*)_total	903.05	[$/year]
HK(Q|T*_hex)_total	924.35	[$/year]
HK(Q|T*_molly)_total	919.05	[$/year]

Problem 15

A.

The optimal order size and frequency for David's Delicatessen's salamis is given below in Table 3.

Table 3: Delicatessen's Optimal EOQ Metrics

Metric	Value	Units
Q*	1297	[unit/order]
T*	0.6175	[year/order]

B.

The on-hand inventory that David should have when he phones his brother to order more salamis is given below in the second row of Table 4.

Table 4: Delicatessen's Reorder Point

Metric	Value	Units
tau <= T*	TRUE	[logical]
R	121	[unit]

C.

David's salamis are a profitable product given that David follows the optimal economic ordering policy shown in Table 3. The expected annual profit is given below in the third row of Table 5.

Table 5: Delicatessen's Annual Profit

Metric	Value	Units
Revenue	6300	[$/year]
G(Q*)	4532.75	[$/year]
Profit(Q*)	1767.25	[$/year]

D.

The trouble with a 4 week shelf life is that it is a shorter duration than the order frequency which means that David will stock out during the year by following the ordering policy outlined in Table 3. The best policy that David can use is given below in the first two rows of Table 6. This item is no longer profitable with this ordering policy as shown by the last row in Table 6.

Table 6: Delicatessen's Shelf Life Constrained EOQ Model

Metric	Value	Units
T_max	0.0769	[year/order]
Q|T_max	162	[unit/order]
tau <= T_max	TRUE	[logical]
R	121	[unit]
G(Q|T_max)	6525.34	[$/year]
Profit(Q|T_max)	-225.34	[$/year]

Section 4.6

Problem 17

A.

The optimal production run size for Wod Chemical Company is given below in Table 7.

Table 7: Wod Chemical Company's Optimal Production Run Size

Metric	Value	Units
Q*	44,612	[unit/order]

B.

The proportion of uptime and downtime in the production cycle is given below by T_1* and T_2* respectively in Table 8.

Table 8: Wod Chemical Company's Production Uptime & Downtime

Metric	Value	Units
T_1*	0.0178	[year]
	24%	[annual]
T_2*	0.0565	[year]
	76%	[annual]

C.

The average annual holding/setup cost for Wod is given below in the first row of Table 9. The expected annual profit of this product for Wod given the optimal economic manufacturing policy outlined in Table's 7 and 8 is shown below in the last row of Table 9.

Table 9: Wod Chemical Company's Annual Holding/Setup Cost and Profit

Metric	Value	Units
HK(Q*)	40,347.49	[$/year]
Revenue	2,340,000	[$/year]
G(Q*)	2,140,347.49	[$/year]
Profit(Q*)	199,652.51	[$/year]

Problem 18

The optimal production run size for Wod Chemical Company if the production rate was infinite is given below in the first row of Table 10. The additional annual cost under this infinite production rate in comparison to the production rate used in Tables 7, 8, and 9 is shown below in the last row of Table 10.

Table 10: Wod Chemical Company's EMQ for Infinite Production Capacity

Metric	Value	Units
Q*|P=Inf	38,892	[unit/order]
G(Q*|P=Inf)	2,146,718.15	[$/year]
G Increase	6,370.66	[$/year]

Additional Problems

Problem 33

A. - C.

The optimal production run size is given below in the first row of Table 11. The fraction of time spent producing high density 3.5 inch disks is given below in the second and third rows of Table 11. The maximum dollar investment in inventory for Diskup is given below in the last row of Table 11.

Table 11: Diskup's Optimal EMQ Metrics

Metric	Value	Units
Q*	72,498	[unit/order]
T_1*	0.1103	[year]
	44%	[annual]
I_max*	40,277	[unit]
	8055.36	[$]

Problem 34

A.

The average annual costs of holding, setup, and production for each location are given below by H, K, and P respectively in Table 12. Based solely on these metrics, moving some operations overseas is more cost-effective for Berry Computer.

Table 12: Berry Computer's Optimal EMQ Costs Comparisons

Metric	Value	Units
H(Q*_US)	3,949.68	[$/year]
H(Q*_Sea)	3,676.96	[$/year]
K(Q*_US)	3,949.68	[$/year]
K(Q*_Sea)	3,676.96	[$/year]
P(Q*_US)	780,000	[$/year]
P(Q*_Sea)	676,000	[$/year]

B.

The pipeline inventory value for each location is given below in Table 13. The comparison of these values show that more product will be on order if some operations are moved overseas. This means that more of the total inventory will be on order as opposed to on-hand if some operations are moved overseas. Therefore, moving operations overseas appears to be better for on-hand inventory control, and agrees with the conclusion reach from Table 12.

Table 13: Berry Computer's Optimal EMQ Comparison

Metric	Value	Units
Q*_US	527	[unit/order]
Q*_Sea	566	[unit/order]

C.

The logistics of keeping operations in the US will be easier than moving them overseas. The much shorter lead-time in the US allows for more reactive time to any sudden swing or variation in demand. The quality of production can be handled and taken care of at the US plant whereas any quality issues from overseas operations won't be noticed until after the product has been shipped. Product with quality issues that cannot be resolved after overseas shipment will have to be sent back or taken as a loss of sales and loss of finished goods inventory, disrupting the optimal order policy either way.