CONSULTING PROJECT
Pricing and Production Decisions at PoolVac, Inc.

PoolVac, Inc. manufactures and sells a single product called the "Sting Ray," which is a patent-protected automatic cleaning device for swimming pools. PoolVac's Sting Ray accounts for 65 percent of total industry sales of automatic pool cleaners. Its closest competitor, Howard Industries, sells a competing pool cleaner that has captured about 18 percent of the market. Six other very small firms share the rest of the industry's sales. Using the last 26 months of production and cost data, PoolVac wishes to estimate its unit variable costs using the following quadratic specification:

$$AVC = a + bQ + cQ^2$$

The monthly data on average variable cost (AVC), and the quantity of Sting Rays produced and sold each month (Q) are presented in the table below.

PoolVac also wishes to use its sales data for the last 26 months to estimate demand for its Sting Ray. Demand for Sting Rays is specified to be a linear function of its price (P), average income for households in the U.S. that have swimming pools (M_{avg}), and the price of the competing pool cleaner sold by Howard Industries (P_H):

$$Q_d = d + eP + fM_{avg} + gP_H$$

The table below presents the last 26 months of data on the price charged for a Sting Ray (P), average income of households with pools ($MAVG$), and the price Howard Industries charged for its pool cleaner (PH):

obs	AVC	Q	P	MAVG	PH
1	109	1647	275	58000	175
2	118	1664	275	58000	175
3	121	1295	300	58000	200
4	102	1331	300	56300	200
5	121	1413	300	56300	200
6	102	1378	300	56300	200
7	105	1371	300	57850	200
8	101	1312	300	57850	200
9	108	1301	325	57850	250
10	113	854	350	57600	250
11	114	963	350	57600	250
12	105	1238	325	57600	225
13	107	1076	325	58250	225
14	104	1092	325	58250	225
15	104	1222	325	58250	225
16	102	1308	325	58985	250
17	116	1259	325	58985	250
18	126	711	375	58985	250
19	116	1118	350	59600	250
20	139	91	475	59600	375
21	152	137	475	59600	375
22	116	857	375	60800	250
23	127	1003	350	60800	250
24	123	1328	320	60800	220
25	104	1376	320	62350	220
26	114	1219	320	62350	220

PoolVac, Inc. incurs total fixed costs of $45,000 per month.

1. a. Run the appropriate regression to estimate the average variable cost function (*AVC*) for Sting Rays. Evaluate the statistical significance of the three estimated parameters using a significance level of 5 percent. Be sure to comment on the algebraic signs of the three parameter estimates.

b. Using the regression results from part 1 *a*, write the estimated total variable cost, average variable cost, and marginal cost functions (*TVC*, *AVC*, and *MC*) for PoolVac.

TVC = _____

AVC = _____

MC = _____

c. Compute minimum average variable cost.
Q_{min} = _____ AVC_{min} = _____

2. a. Run the appropriate regression to estimate the demand function for Sting Rays. Evaluate the statistical significance of the three estimated *slope* parameters using a significance level of 5 percent. Discuss the appropriateness of the algebraic signs of each of the three *slope* parameter estimates.

b. The manager at PoolVac, Inc. believes Howard Industries is going to price its automatic pool cleaner at $250, and average household income in the U.S. is expected to be $65,000. Using the regression results from part 2 *a*, write the estimated demand function, inverse demand function, and marginal revenue function.

Demand: _____

Inverse Demand: _____

Marginal Revenue: _____

3. Using your estimated cost and demand functions from parts 1 and 2, what price would you recommend the manager of PoolVac, Inc. charge for its Sting Ray? Given your recommended price, estimate the number of units PoolVac can expect to sell, as well as its monthly total revenue, total cost, and profit.

P: _____

Q: _____

TR: _____

TC: _____

Profit: _____

4. For the profit-maximizing solution in question 3, compute the point elasticity of demand for Sting Rays.

E = _____

In the profit-maximizing situation in question 3, a 5 percent price cut would be predicted to _____ (increase, decrease) quantity demanded of Sting Rays by _____ percent, which would cause total revenue to _____ (rise, fall, stay the same) and profit to _____ (rise, fall, stay the same).

5. For the profit-maximizing solution in question 3, compute the income elasticity of demand for Sting Rays.

E_M = _____

a. Is the algebraic sign of the income elasticity as you expected? Explain.

b. A 10 percent increase in M_{avg} would be predicted to _____ (increase, decrease) quantity demanded of Sting Rays by _____ percent.

6. For the profit-maximizing solution in question 3, compute the cross-price elasticity of demand for Sting Rays.

E_{XR} = _____

a. Is the algebraic sign of the income elasticity as you expected? Explain.

b. A 3 percent decrease in P_H would be predicted to _____ (increase, decrease) quantity demanded of Sting Rays by _____ percent.

7. If total fixed costs increase from $45,000 to $55,000, what price would you now recommend in order to maximize profits at PoolVac? Compute the number of units sold at this price, total revenue, total cost and profit:

P: _____

Q: _____

TR: _____

TC: _____

Profit: _____

8. If the manager of PoolVac wanted to maximize total revenue instead of profit (a bad idea), the manager would charge a price of $_____. At this price, PoolVac's profit would be $_____, which is _____ (higher than, lower than, the same as) the profit in question 3.