Problem A.

Dundee Crocs, Inc. (DC) is a small Aussie firm that raises crocodiles. Its output consists of two joint products, croc steaks, which are sold to exotic game restaurants, and croc hides, which are sold to producers of leather goods (boots, purses, etc.). Each time DC processes a crocodile, it obtains one hide and 25 crocodile steaks. The hides are sold whole, and the steaks are sold in boxes of 25.

Dundee estimates that the annual demand curve for hides is \( Q_H = 1,000 - 5P_H \), while that for steaks is \( Q_S = 1,800 - 10P_S \). (\( Q_S \) is the number of 25-steak boxes sold.) The firm’s annual total cost for the production of the crocs is given by the equation \( TC = 100,000 + 4Q + 0.06Q^2 \), where \( Q \) represents one hide and a box of steaks.

(a) How many boxes of crocodile steaks should DC produce?
\[
MR_h = 0 \text{ at } Q = 500. \text{ Then, } MR_s = 180 - 2Q = 80 \\
\text{and } MC = 4 + 12Q = 64. \text{ } MR_s > MC, \text{ so firm will max } P \text{ where } MR_s = MC.
\]
\[
180 - 2Q = 4 + 12Q \\
176 = 14Q \\
Q = 550 \\
\]

(b) How many croc hides should the company produce?
It must produce same number as boxes of steaks, so \( Q = 550 \)

(c) How many boxes of steaks should Dundee Crocs sell, and what should be its price per box?
\[
Q_s = 550; \quad P_s = 180 - 55 = 125
\]

(d) How many croc hides should Dundee sell, and at what price per hide?
\[
Q_H = 500; \quad P_H = 100
\]

(e) What will be Dundee’s total annual profit or loss?
\[
\Pi = 68,750 + 50,000 - 100,000 - 2200 - 18,150 \\
= -1600, \text{ a loss minimum.}
\]
Problem B.

Chokalot Corp. is the nation's largest producer of rebuilt automobile smog pumps to fit cars built by Galaxy Motors (GM). Chokalot typically charges a standard price for any pump to fit a GM auto. Management realizes that its industry is characterized by a relatively large number of smaller firms that are followers in the sense that they will always charge exactly the price that Chokalot sets.

Currently, Chokalot estimates that the monthly market demand curve for the pumps has the following equation:

\[ Q_d = 1640 - 15P \]

Chokalot knows that its own monthly total cost can be represented by the equation \( TC = 12,000 + 2.5Q + 0.001Q^2 \). In addition, it has estimated that the smaller firms' supply curve can be represented by the equation \( Q_S = 40 + 10P \).

1. Write the equation for the demand curve facing Chokalot

\[ Q_L = 1600 - 25P \quad \text{and} \quad P = 64 - 0.64Q_L \]

2. Determine the price that Chokalot will charge and the quantity of output that it will sell.

\[ MR = 64 - 0.08Q_L = 7.5 + 0.002Q_L = MC \]

\[ 0.082Q_L = 61.5 \quad Q_L = 750 \]

\[ P = 64 - 30 = 34 \]

3. Determine the quantity that the smaller firms will supply and the market quantity demanded.

\[ Q_S = 40 + 340 = 380 \]

\[ Q_{dd} = 1640 - 380 = 1130 \]

4. Calculate total profit for Chokalot.

\[ \Pi = 25,500 - 12,000 - 1875 - 5(2.5) = \$11,042.50 \]
Problem C.

Consolidated Communications of America (CCA) operates in a non-collusive oligopolistic market where firms tend to base their strategies on good old-fashioned fear. CCA believes that at its current price its demand curve will be \( Q = 3,000 - 20P \) if it raises price, since it expects that other firms will not follow a price increase. However, for price cuts it believes its demand curve is \( Q = 1,800 - 10P \), since other firms are expected to follow a reduction in price.

1. With the above assumptions, what are CCA’s current price and quantity sold?

\[
3,000 - 20P = 1,800 - 10P \\
10P = 1,200; \quad P = 120 \\
Q = 600
\]

2. Suppose CCA’s total cost function is:

\[
STC = 20,000 + 3Q + 0.05Q^2 \\
AVC = 3 + 0.05(600) = 33 \\
SAC = 33.33 + AVC = 66.33
\]

Is CCA maximizing its profit at the quantity and price you found in (1)? Explain why or why not.

At \( Q = 600 \); \( MC = 3 + 1.0Q = 63 \)

For \( Q = 3000 - 20P \)

\[
P = 150 - 0.05Q \\
MR = 150 - 1Q \\
90 > 63 > 60; \quad 90 \text{ is max. (} P \text{ > SAC)}
\]

For \( Q = 1800 - 10P \)

\[
P = 180 - 0.1Q \\
MR = 180 - 0.2Q \\
90 > 63 > 60; \quad 90 \text{ is max. (} P \text{ > SAC)}
\]

3. Now suppose that CCA has made an error in its estimate of the total cost function so that the actual total cost is:

\[
STC = 20,000 + 7Q + 0.08Q^2
\]

With this revised total cost function, what is the firm’s profit-maximizing price, output, and total profit?

\[
MC = 7 + 1.4(600) = 103; \quad 103 > MR_u
\]

\[
\therefore \quad \text{MR}_u = MC
\]

\[
7 + 1.16Q = 150 - 1Q \\
2.26Q = 143; \quad Q = 650 \\
P = 150 - 27.5 = 122.5
\]

\[
\pi = 67,375 - 20,000 - 3850 - 24,200 = 19,325
\]