Question 1 Solution

(a) Let x_1 = power produced at Plant 1 in MW-hr

Let x_2 = " " " Plant 2 " "

For lowest cost operation

$$x_1 + x_2 = 200{,}000 \quad \text{and} \quad MC_1(x_1) = MC_2(x_2)$$

$x_1 = 130{,}811$ $\quad MC_1(130{,}811) = \$434.01$

$x_2 = 69{,}189$ $\quad MC_2(68{,}189) = \$434.01$

200,000 MW-hr

Note both x_1 & x_2 are less than capacity; therefore, this is a feasible solution.

(b) Discussion should include what if $MC_1 \neq MC_2$

Case ① $MC_1 > MC_2$ } and how lower cost can be obtained by shifting power production from higher MC plant to lower MC plant.

Case ② $MC_1 < MC_2$ }

(c) $200{,}000 \times 1.4 = 280{,}000$.

Note in Part (a), Plant 1 is running close to capacity (130,811 vs. 132,000). With a 40% increase, it is likely it will run at maximum capacity.

$\therefore \quad x_2 = 280{,}00 - 132{,}000 = 148{,}000$

Verify $MC_1(132{,}000) = \$435.98$; $MC_2(148{,}000) = \$634.77$.

MC for utility now \$634.77

(d) Since Kingston can buy power for \$475 and the MC_2 is \$634.77, it makes sense to reduce production at Plant 2 until it runs at a level where $MC_2 = \$475.00$

$$MC_2(x_2) = \$475.00 \Rightarrow x_2 = 82{,}874 \text{ MW-hr}$$

Import = 280000 − 132000 − 82,874 = 65,126 MWhr.

Note this is optimal as $MC_1(132{,}000) = \$435.98$

and $MC_2(82{,}874) = MC_{IMPORT}(65{,}126) = \$475.00$

(e) MC for the utility now \$475.00.

Question 2 Solution

(a) Debt: $10000000 \times .3 = 3000000$

1000000 Bank

$\boxed{2000000}$ Bonds

Equity: $10000000 \times .7 = 7000000 \quad \therefore \frac{7000000}{25} = \boxed{280{,}000 \text{ shares}}$

(b) % Cost Debt $k_d = \frac{1}{3} 6\% + \frac{2}{3} 10\% = \boxed{8.67\%}$

(c) Cost of Capital: $k = \frac{D}{V} k_d + \frac{E}{V} k_e = (0.3)(8.67\%) + (0.7)(14\%)$

$= \boxed{12.40\%}$

(d) Projects whose rate of return exceeds the cost of capital add value to the firm. Therefore, accept the 14.1% investment.

Question 3 Solution

The most appropriate engineering economic principle is to look forward and ignore sunk costs.

The alternatives are:

1. Complete the Corvette restoration
2. Abandon the project.

Ignoring sunk costs, in Alternative 1 John will spend $25,000 to receive $40,000 - a net gain of $15,000

In Alternative 2, he will spend nothing to receive $7,500 - a net gain of $7,500.

Therefore, complete the restoration for a net gain of $15,000. This is $7,500 better than abandoning the project

Less preferable approach, include all costs:

Alternative 1:

$40,000	- revenue
- 20,000	- first repair
- 25,000	- second repair
- 10,000	- purchase
-15,000	Net Loss

Alternative 2:

$7,500	- revenue
-20,000	- first repair
-10,000	- purchase
-22,500	Net Loss

Lose $7,500 more with Alternative 2.

Question 4 Solution

(a) The stock prices should rise by the amount of retained earnings. If a company worth $X adds $Y to its bank balance, it should be worth $(X+Y).

A: $43.20, B: $20.72, C: $78.50

(b) Return is composed of capital gains plus dividends (=EPS). The company that has the best return on equity was the best investment. ROE = (earnings/share) / (price/share).

ROEs are A: 4.20/42.00 = 10%; B: 2.22/18.5 = 12%; C: 6.50/76.00 = 8.6%

It might be tempting to think that C is the best investment since it had the highest earnings per share. One must remember that a high price ($76.00) was paid to purchase that slice of

earnings. Likewise even though A and C have large dividends, B was the better investment due to price appreciation. Even though we didn't receive a dividend, we could sell the share and net a healthy gain over the original price that way.

(c) Even when not paying a dividend, the company's value increases when it makes a profit. Because shareholders are the company's owners, they benefit indirectly when the company's bank balance increases. Note that a shareholder cannot access that cash directly. They own the company, which owns the cash. If they wish to sell their part of the company someone will be willing to pay more for it as a result.

(d) Earnings include a number of non-cash items (depreciation/amortization), so the company may have the cash to pay dividends despite low (or negative) earnings. Further, companies can opt to pay dividends out of previous periods' retained earnings (cash on hand); some will decide to do so even in bad times because reducing dividends is generally not popular with investors.

Companies may prefer not to pay dividends if they need the cash and can put it to good use. Retained earnings are an alternative source of capital to offering new shares or debt. A company will generally opt not to pay dividends if it has attractive investment projects available to it (e.g. start-ups will need the cash to grow).

Question 5 Solution

The three options are identical.

In (a), you will take home $100k. Since you and your partner are both taking $20k more in salary, the profit will decrease by $40k to $20k. Your half of that remaining profit is $10k, which you will receive in dividends. Net result: you get $100k salary plus $10k dividend and the company is still worth $600k.

In (b), the salaries do not change so the company makes a $60k profit again. You receive your salary of $80k plus a dividend of $30k (50% of total profit). The net benefit to you is $110k, and the company is still worth $600k.

In (c), the profit will decrease by $20k since salary expense increases by $20k ($10k each), leaving $40k net profit for the company. Of that, 50% ($20k) is paid out in dividends and $20k is retained, increasing the company's value to $620k. Result is you receive $90k salary, $10k of dividends (50% of $20k), and $10k (50% of $20k = $620k-$600k) in increased value in the company.

In summary, if the impact of taxes is ignored, it does not matter to your net wealth whether you draw a salary, pay a dividend, or retain earnings within the company that you own.

Obviously on a practical level it is necessary to pay a salary and/or dividends so you have cash with which to pay your regular living expenses.