Q No 3

Solution:

x = amount of paper towel

y = amount of toilet paper

⇒ 1 ton of toilet paper required 1 ton of raw pulp

⇒ 1 ton of paper towel required 1 ton of raw pulp

⇒ Profit for paper towels is 10$ per ton of pulp

So 10x profit for x paper towels

⇒ Profit for toilet paper is 100$ per ton of pulp

100y profit y toilet paper ~~to~~.

So maximize $Z = 10x + 100y$

From question:

⇒ company has a supply of 8000 tons of pulp/month

So $x + y \leq 8000$

⇒ company has to produce 200 tons of paper towel each month so $x \geq 200$

Shipping capacity of company is 100,000 ton-miles

1 ton - 100,000 miles

Therefore company can ship $(x+y)$ tons of product to $\frac{100,000}{x+y}$ miles.

$$\Rightarrow \frac{100,000}{x+y} - y = \frac{100,000 - xy - y^2}{x+y}$$

Company can ship y tons of product

$$\frac{100,000}{x+y} - x = \frac{100,000 - xy - x^2}{x+y}$$

$\Rightarrow$ paper towel delivered 10 miles away

$\Rightarrow$ toilet paper delivered 35 miles away.

So from above condition

$$\frac{100,000 - xy - y^2}{x+y} \leq 10$$

$$\Rightarrow 100,000 - xy - y^2 \leq 10(x+y)$$

$$\Rightarrow y^2 + xy + 10(x+y) \geq 100,000$$

$$\frac{100,000 - xy - x^2}{x+y} \leq 35$$

$$\Rightarrow 100,000 - xy - x^2 \leq 35(x+y)$$

$$x^2 + xy + 35(x+y) \geq 100,000$$

$$Z = 10x + 100y$$

Such that

$$x + y \leq 8000$$

$$x \geq 200$$

$$x^2 + xy + 35(x+y) \geq 100,000$$

$$y^2 + xy + 10(x+y) \geq 100,000$$

$$y \geq 0$$