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Answer to the Q. No. 2

X_1	X_2	Y
35	345	02
43	543	01
23	456	0

Normalize:

For X_1,

mean $\mu_1 = \frac{35+43+23}{3}$

$= 33.67$

Range of X_1, $S = 43 - 23 = 20$

$\therefore x_i' = \frac{x_i - \mu_i}{s_i}$

$X_{11} = \frac{35 - 33.67}{20} = 0.067$

$X_{12} = \frac{43 - 33.67}{20} = 0.3165$

$X_{13} = \frac{23 - 33.67}{20} = -0.53$

For X_2,

mean, $\mu = \frac{345+543+456}{456} = 448$

Range, $S = 543 - 345 = 198$

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$$x_{21} = \frac{345 - 448}{198} = -0.52$$

$$x_{22} = \frac{543 - 448}{198} = 0.48$$

$$x_{23} = \frac{456 - 448}{198} = 0.04$$

For Y,

mean, $\mu = \frac{2+1+0}{3} = 1$

range, $s = 2$

$\therefore y_{11} = \frac{2-1}{2} = 0.5$

$y_{12} = \frac{1-1}{2} = 0$

$y_{13} = \frac{0-1}{2} = -0.5$

So we get scaled data from $[-1 < x < 1]$

X_1	X_2	Y
0.067	-0.52	0.5
0.317	0.48	0
-0.53	0.04	-0.5

We can scale this down this data to ~~$[-0.5, 0.5]$~~ $[-0.5 < x < 0.5]$ by multiplying each element with 0.5.

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So final dataset:

x_1	x_2	y
0.0335	-0.26	0.25
0.1585	0.24	0
-0.265	0.02	~~-0.5~~ -0.25

Ans.

Answer to the Q. No. 1

x_1	x_2	y	$\hat{y}$
2	3	2	
2	4	3	
3	3	4	
4	4	5	

Here, $\hat{y}^{(i)} = h_\theta(x) = \theta_0 + x_j^{(i)}\theta_1 + x\, h_\theta(x)$

$= \theta_0 + \theta_1 x_1 + \theta_2 x_2$

$\theta_0 = 2$

$\theta_1 = 1$

$\theta_2 = 0$

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$\therefore \hat{y}_1 = \theta_0 + \theta_1 x_1 + \theta_2 x_2$

$= 2 + 1 \times 2 + 0 \times 3$

$= 4$

$\hat{y}_2 = 2 + 1 \times 2 + 0 \times 4$

$= 4$

$\hat{y}_3 = 2 + 1 \times 3 + 0 \times 3$

$= 5$

$\hat{y}_4 = 2 + 1 \times 4 + 0 \times 4$

$= 6$

So it looks like

x_1	x_2	y	$\hat{y}$
2	3	2	4
2	4	3	4
3	3	4	5
4	4	5	6

Cost function

$$J(\theta) = \frac{1}{2m} \sum_{i=1}^{m} (\hat{y}_i - y_i)^2, \text{ here } m = 4$$

$$= \frac{1}{2 \times 4} \{(4-2)^2 + (4-3)^2 + (5-4)^2 + (6-5)^2\}$$

$$= \frac{1}{6} (4 + 1 + 1 + 1) = \frac{7}{6}$$

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$\therefore J(\theta) = 1.1667$

Ans.